

**High Energy Astrophysics Research  
and Programmatic Support  
Contract No. NAS5-32490**

*INTERIM  
7/11/90  
018923*

**Technical Report  
for  
July 1, 1994 through September 30, 1994**

**NASA/Goddard Space Flight Center  
Contracts Office  
Mail Code 286  
Greenbelt, Maryland 20771**

**by**

**Universities Space Research Association  
Mail Code 610.3  
Building #26, Room 215  
NASA/Goddard Space Flight Center  
Greenbelt, Maryland 20771**





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October 27, 1994

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Enclosed is a copy(ies) of the Technical Report for the USRA/Goddard Visiting Scientists Program under contract NAS5-32490 for the period of July 1, 1994 through September 30, 1994.

If you have any questions, please don't hesitate to contact us.

David V. Holdridge  
Project Manager



**October 27, 1994  
Contract No. NAS5-32490  
Technical Reports  
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Subject: Enclosed is the Technical Report for the Period  
July 1, 1994 - September 30, 1994



**High Energy Astrophysics Research  
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**Technical Report**

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**Brief Summary of Task Activities under Contract NAS5-32490 During the Period of  
July 1, 1994 through September 30, 1994**

**(Individual Project Reports are attached on the indicated pages)**

**Summary notation and actual reports are sequentially listed by Task Number**

<b><u>Page #</u></b>	<b><u>Task Number</u></b>	
01	<u>93-01-00</u>	<b>Angelini</b> assisted in the release of the XRONOS 4.02 and XIMAGE 2.5 and began work on a new project, the creation of the ROSAT catalogue using the available public pointed data. Scientific areas of research this quarter included the 1keV emission line in 4U1626-67, the optical identification of the serendipitous sources in HH-1, the super soft transient in M31 and the analysis of ASCA data of the X-ray pulsar GX301-2.
04		<b>Drake</b> continued to monitor the anonymous ftp and Gopher services and the ADS access provided by the HEASARC to the scientific community. He also reviewed 39 proposals submitted to the National Radio Astronomy Observatory for observing time on its facilities and reduced the data obtained in 12.5 hours of VLA observing time. Dr. Drake submitted 2 ASCA AO-3 proposals and several others as Co-I and had a paper accepted for publication.
12		<b>George</b> continued his work in maintaining and developing the OGIP Calibration Database and made additions and adjustments for FTOOLS s/w. His personal research efforts this quarter were primarily in the areas of: reporting the results of a ROSAT PSPC monitoring, discovering a OVII emission line in the ACSA spectrum of the Seyfert galaxy NGC 3783 and observing the Flat-Radio Spectrum (FRS) quasar NRAO 140. Dr. George submitted two papers for publication and has had six previously submitted papers accepted for publication (in refereed journals).
17		<b>Whitlock</b> cleaned the corruption from the Vela 5B data and then converted the coordinate-ordered data into FITS and put on-line for community access. She also began work on the data analysis from the Cosmic X-ray Spectroscopy Experiment from the OSO 8 satellite and continued to provide support to both R. Shubert's research on cosmic background analysis of the Vela 5B data and the R. Remillard's reformatting efforts of the HEAO A-3 data. Dr. Whitlock submitted proposals to the ASCA AO3 announcement and awaits responses for four papers submitted for publication.



<u>Page #</u>	<u>Task Number</u>	
19	<u>93-01-00</u> (continued)	<b>Corcoran</b> supervised the data ingest into the NDADS archive task as the 185 US ROSAT datasets and 385 German/UK ROSAT data sets were released to the archive. He responded to 627 emails regarding the ROSAT public archive and continued to supervise the development of the RDF software. Dr. Corcoran had a paper accepted and submitted a proposal for ASCA AO3 as a PI and two others as Co-I.
21	<u>93-02-00</u>	<b>Snowden</b> the software for analysis of the ROSAT PSPC observations of extended sources and the diffuse X-ray background has been officially released to the public this quarter. His ROSAT Users' Handbook is very close to official release. Dr. Snowden worked with the summer graduate students from the University of Maryland. In addition, he has had two lead-author papers accepted for publication.
23		<b>Turner</b> worked on a cookbook for ROSAT analysis using the new xselect/ftools. She also continued her analysis of PANTER ground calibration data (from the engineering model of the PSPC) and spent a significant amount of time answering email and telephone queries on data analysis issues and software problems. Dr. Turner worked on four papers, two of which were submitted for publication.
25	<u>93-03-00</u>	<b>Ebisawa</b> tested and verified two ASCA analysis programs and modified the <i>mkfilter2</i> program, which produces a filter file used for ASCA data cleaning. In addition, he helped make four ASCA observation plans for US ASCA Guest Observers and read 71 ASCA AO3 proposals and assessed their technical feasibility toward the proposal review. He also analyzed the ASCA data of Cyg X-1 and is in the process of drafting a paper for it. Dr. Ebisawa gave two invited talks, submitted two ASCA AO3 proposals, had three papers published, one accepted for publication and six others submitted.
27		<b>Mukai</b> spent a large amount of time supporting the community in preparing observing proposals for ASCA AO3. He was on duty to help US PIs plan their observations for a two-week period in the long-term timeline. He also started the design and testing of the Rev 1 processing system. Dr. Mukai was heavily involved in the completion of a paper where he was a co-author. This paper has been accepted for publication. He concentrated on writing two ASCA AO3 proposals as PI and several others as Co-I.



<u>Page #</u>	<u>Task Number</u>	
28	<u>93-04-00</u>	<b>Lochner</b> assisted in writing the technical appendix and developing materials for the upcoming XTE Research Announcement. In addition, he participated in reviewing the various parts of the NRA materials and enhanced the timing simulation tools which will be made available to proposers for developing their XTE observations. He also continued the collaborative work on the development of shot models for Cyg X-1.
30		<b>Rots</b> completed the design of the FITS database and its related directory tree structure and actively participated in the development of the Technical Appendix to the XTE NRA. He also completed the development efforts of an intelligent EDS configuration selection assistant named <i>recommd</i> . Dr. Rots began his investigation in performance of different period searching algorithms and will add a Fourier algorithm to his list.
34		<b>Schlegel</b> spent much of this quarter supervising and working with 3 students whose efforts were in the areas of analyzing the accretion disk images obtained by back projection of the $H\beta$ and $H\gamma$ emission lines, examining the ROSAT PSPC data on galaxy NGC 1313 and studying the BBXRT data on the galaxy clusters Abell 262 and Abell 496. He also researched the X-ray light curve of SN1978K. He also worked on preparations for the XTE NASA Research Announcement as well as revamping the guest observer proposal preparation tools. Dr. Schlegel had three papers accepted for publication and another submitted.
37	<u>93-05-00</u>	<b>Giles</b> continued work as the Software Manager for the PCA experiment software development and deliveries to the XTE Science Operations Center. He also continued to support the Goddard team developing the PCA detectors for the XTE satellite. His team continued to play an important role in assisting the SOC by remaining at the "leading edge" of the IT interfaces to the SOF. Dr. Giles has had his paper given in Australia formally written up and submitted for publication.
40		<b>Zhang</b> delivered all 5 proportional counters to the XTE spacecraft team for integration, and participated in the 2nd XTE integration plus end-to-end testing. In particular, he was responsible for checking the accuracy of the spacecraft clock as well as the software that manipulates the clock data. He also spent a large portion of the quarter preparing the necessary documents for release to the general astrophysics community and initiated a project to build a monochromator to be installed in the Goddard X-ray beam facility. Dr. Zhang wrote a paper that is about to be submitted for publication and assisted J. Swank in preparing a proposal justifying the science that XTE can do.



<u>Page #</u>	<u>Task Number</u>	
43	<u>93-06-00</u>	<b>Chen</b> was involved in scientific research this quarter in the areas of understanding the COMPTEL <sup>26</sup> Al 1.8 MeV map features, compilation and classification of all known X-ray nova light curves, a new model of nonthermal synchrotron radio emission from massive stellar winds, understanding the black hole X-ray novae using disk instability models and searching for 1.8 MeV Emission of <sup>26</sup> Al from nearby supernova remnants. Dr. Chen also submitted a proposal to ASCA AO3.
44	<u>93-07-00</u>	<b>Christian</b> was very active in the data analysis, writing and editing a paper regarding ALICE (A Large Isotopic Composition Experiment) and the Voyager Cosmic Ray System. He also continued work on the analysis of the data from the successful 1992 flight and was responsible for the onboard command and data handling (C&DH) system as well as the ground support equipment (GSE) for ISOMAX. Dr. Christian served as an assistant to the Project Scientist for ACE (Advanced Composition Explorer) and as the system manager for the new UNIX computer system the group has bought for use in IMAX and ISOMAX data analysis.
46	<u>93-09-00</u>	<b>Barthelmy</b> began making the mods to the GSE program that will handle the new technology piggyback instrument (PORTIA) and the new wide-field collimator and blocking crystal for the GRIS Project. For the BACODINE project, two more operations were added: another radio telescope and a group of serious amateurs. His renewal proposal for BACODINE to the GRO Guest Investigator has been accepted, as have two other proposals for GRO Phase IV where he was a Co-I.
47	<u>93-10-00</u>	<b>Palmer</b> continued his analysis of Gamma-Ray Burst (GRB) data from the BATSE SD instrument on the Compton Gamma-Ray Observatory (GRO) and searched for radio counterparts of GRBs. He also made preparations for the Transient Gamma-Ray Spectrometer (TGRS) for launch on the WIND spacecraft, scheduled for November 1994 and worked on the preliminary design of a new GRB instrument which will use a coded aperture. Dr. Palmer has also been assisting a summer intern, J. Dodoo in simulating the TGRS instrument's response to gamma radiation, using a package called GEANT.





<u>Page #</u>	<u>Task Number</u>	
49	<u>93-10-00</u> (continued)	<b>Seifert</b> was involved in a series of spacecraft tests, the final tests of TGRS and the WIND spacecraft before and after delivery of the spacecraft to Cape Canaveral. He supported three Mission Profile Tests, three Limited Performance Tests, a comprehensive Performance Test, as well as the Added Confidence Test this quarter. In addition, Dr. Seifert continued the development of the TGRS data analysis software.
51	<u>93-11-00</u>	<b>Mitchell</b> assisted in the development work for the ISOMAX balloon program and the analysis of the 1992 IMAX flight. He also conducted an analysis of data from accelerator experiments and performed development work on new flight and ground based experiments. Other areas of efforts this quarter includes the MASS/WiZard, SMILI, E878 (ANTI), Experiments E683H and E849H as well as the E938H (Transport Collaboration) and the TIGER. Dr. Mitchell worked on preparing three new paper for publication.
55	<u>93-14-00</u>	<b>Soong</b> carried out research which was part of the center DDF proposal and is proceeding to apply the thin foil mirror technique to the next generation X-ray telescope. He also analyzed the ASCA data, working on the galactic binary x-ray emitters, such as Her X-1, Vela X-1 and 4U0614+091. Another proposal for lab development in the next three years to the NASA/HQ was funded for mirror research.
56	<u>93-15-00</u>	<b>Yaqoob</b> began data analysis for ASCA on four objects obtained from the AO-1 period, but the project will also utilize data from the ASCA Performance Verification phase for similar classes of object. Dr. Yaqoob has submitted a total of fourteen proposals for ASCA AO-3. He is PI on thirteen of these proposals and a Co-I on one. In addition, he has had four papers accepted for publication.
58	<u>93-16-00</u>	<b>Stahle</b> conducted a major test of the X-ray Spectrometer front end assembly and analog signal electronics, selecting and preparing the detector array. She also provided direction during the actual test, determining what data was needed and analyzing that data. In addition, she fine-tuned a procedure for simultaneous attachment of all 36 X-ray absorbers on the detectors of an XRS calorimeter array and coordinated the X-ray astrophysics contribution to the AAS observatory report from the Laboratory for High Energy Astrophysics at Goddard. Dr. Stahle submitted a proposal for ASCA AO3 and a second as Co-I.



<u>Page #</u>	<u>Task Number</u>	
59	<u>93-17-00</u>	<b>Loewenstein</b> began work on deriving the limits on dark matter in clusters of galaxies from ASCA data. Scientific research this quarter were in the areas of ASCA observation of the NGC 4636: dark matter and metallicity gradient and the discovery and implications of very low metal abundances in NGC 1404 and NGC 4374, both of which were written as papers, submitted and accepted for publication. Dr. Loewenstein continued his research in the analysis of the ROSAT PSPC observations of the elliptical galaxy NGC 4697 and submitted three ASCA AO-3 proposals as PI.
60	<u>93-19-00</u>	<b>Hubeny</b> continued his work in theoretical analysis of hot stars, proceeding in the analysis of the individual stars in the R136a cluster and continued his collaborative efforts on radiative transfer with partial redistribution. He also wrote a chapter for the book "Computational Astrophysics," which was supplemented by a computer program intended to be a standard reference program of the field. Dr. Hubeny submitted two papers for publication and gave two invited talks.
62	<u>93-20-00</u>	<b>Barrett</b> completed the duplication of tapes for SAS-2 FITS in preparation for the NSSDC to ingest them for storage. The transfer of the SAS-2 data from 9-track magnetic tape to 8mm DAT tape is near completion. He also worked on developing a list of publications about the Compton Gamma-Ray Observatory and related issues. In addition, Dr. Barrett prepared and submitted two ASCA proposals and two proposals for the Infrared Space Observatory (ISO), one as PI and the other as Co-I.
66		<b>Finger</b> made good progress in the production and delivery of archival data for CONT and DISCLA FITS files for TJD 8962 to 9292 and pulsar low level FITS files for TJD 8565 to 8938. Seven full exobyte tapes of data were delivered. In Amsterdam, Dr. Finger worked on the Vela X-1 guest investigation, finalizing the data quality control procedures and calculating pulse phases for the set of about 12,000 pulse profiles. He wrote two papers and presented a talk this quarter.
68		<b>Mattox</b> wrote approximately 100 email messages in support of EGRET guest investigator activities and made or received around 20 phone calls. He also wrote a proposal to observe EGRET sources with the ISO Infrared Observatory and finished a paper for submission.



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**93-20-00**  
(continued)

**Shrader** oversaw efforts of preparing a database of approved targets for input into the timeline generation process, drafting notification letters to the 236 proposers and preparing data-rights guidelines for the approved guest investigations and the principle investigator teams for the report period in preparation for the Cycle 4 CGRO Program. The GRONEWS bulletin board was updated to include summaries of the Cycle 4 peer review results. Dr. Shrader performed analysis of OSSE data covering two recent classical novae outbursts, Nova Hercules 1991 and Nova Cygni 1992. Extensive analysis on a large body of multiwavelength data for the Seyfert 1 galaxy Markarian 841 was performed.

**71**

**Stacy** continued to maintain the GI workstation area at UNH and is pursuing a NASA ADP project to analyze COBE data. He also made preparations for the installation of COMPASS at the SSC, pending the setup of the necessary hard and software. Dr. Stacy is a Co-I on three IDEA proposals recently submitted.



University Space Research Association  
Goddard Visiting Scientist Program

Employee name: Lorella Angelini Task Number: 5030-01A-39

Period: 1 July - 31 September 1994

### Software Development and maintenance

The XRONOS 4.02 and XIMAGE 2.5 was released at the end of August. Since the realise, I made small changes to XIMAGE to allow the extract command to write more information in the spectra and light curve output files. The version that we now running at GSFC is XIMAGE 2.51. A 'patch' realise has been made available for outside user at the end of September.

### The WGA Catalogue

At the end of June I started working on a completely new project, the creation of the ROSAT catalogue using the available public pointed data. This project is done in collaboration with Nick White and Paolo Giommi. The label WGA (name of the catalogue) is for White, Giommi, Angelini. The processing was done using XIMAGE 2.51 (scheduled with a C-shell script) to perform the following step:

- a) read an event file,
- b) create two images in counts for the inner circle (about 10 arcmin radius) and for the outer circle,
- c) run a detection software in both inner and outer images and create output file containing position, count rate and correction for each detection ,
- d) using the list of detections obtained with step c and the event list file we obtained :
  - 1) the hardness and the softness ratio,
  - 2) a 'timing' image, which gives directly a measurement of the variability associated to a source (Note: this is a completely new technique in X-ray astronomy (see later also scientific project),
  - 3) a 'color images, which gives directly information on the source spectra.

The number of event file processed were 2200 and the number of detection found are 70051. A database table accessible by Browse will be made available probably for the HEAD meeting (November 1994) where the catalogue will be presented for the first time ('*The WGA Catalogue of ROSAT Point Sources*', White, Giommi, Angelini). This is the first ROSAT catalogue available (the survey is not ready yet), which is now the largest catalogue of sources detected in soft X-ray band. With a such catalogue will be possible to start a number of scientific projects based on samples of different type of sources.

In the near future a good amount of work is required to 'clean' and 'check' each of the 70051 detections found, before obtaining the final version. A programmer/analyst, Steve Fantasia, is working under my supervision on the cleaning and quality control of each detection.

### Scientific Research:

- 1) *The 1 keV emission line in 4U1626-67.* The spectra taken with ASCA shows evidence of a strong emission at 1 keV, consistent with Neon emission. The Ly- $\alpha$ , Ly- $\beta$ ,

and Helium-like- $\alpha$  lines are detected at 1.05, 1.10 and 0.95 keV, respectively as well as a L- $\alpha$  Ne recombination edge at 1.20 keV. This is the first time a recombination line has been detected from a cosmic X-ray source. The strength of the neon emission compared to the expected iron L complex implies a factor of 10 Neon overabundance relative to iron. Neon is a by-product of Helium burning and its overabundance in this system indicates that the companion star is burning, or has in the past burnt Helium. This supports the evolutionary scenario for 4U1626-67 where the donor star is a helium-burning star.

I presented the above work in July at the COSPAR meeting. I am currently working on a paper which will be submitted in Nature.

2) *The optical identification of the serendipitous sources in HH-1.* In collaboration with S.Pravdo, we finished the paper which includes the analysis of the second ROSAT HRI observation and the optical data obtained at Palomar. The paper has been submitted in AP.J. on 1 September.

3) *Analysis of ASCA data of the X-ray pulsar GX301-2.* This work is in collaboration with Steve Pravdo and Charles Day. The analysis of the X-ray data which include pulse phase spectroscopy and search for timing properties has been concluded. The major finding is the detection of iron line and edge varying across the pulse. We identify the serendipitous as an M emission line star, found in the X-ray image, using a guest facilities as the ATT (Australian souther observatory). We obtained the high energy spectra from BATSE data, which I will used to fit together with the average spectra obtained with ASCA SIS.

4) *Super Soft Transient in M31.* During the processing to create the WGA catalogue, we found, using the new X-ray timing images, a number of variable sources . The work to identify them is still underway, but one in particular was quite interesting. This is a transient found in M31 which might be recurrent, with spectral characteristics similar to a super-soft source. The luminosity of the object is  $3.4 \times 10^{38}$  erg/s. The discovery is remarkable because if this is not a foreground source is the first supersoft recurrent transient found in M31.

It appeared as *IAUC 6064*, and we now working on the paper. The technique we used to create time variability images was presented at the ADASS meeting in Baltimore (September 1994, 'A Method for Visualizing Time Variability in X-ray Images', Giommi, White, Angelini).

5) *ASCA A3* I worked at 5 ASCA proposal for the A3, one as PI 4 as Co-I.



Lorella Angelini

Possible 1995 trips

- 1) Tucson  
AAs Meeting  
5 days  
January, 1995
- 2) Los Angeles, Palomar/JPL  
optical observing time if proposal approved  
1995
- 3) Noodwijk, The Netherlands  
EXOSAT data  
14 days  
1995
- 4) Vienna, Austria  
IAU Symposium No. 176  
Stellar Surface Structure  
5 days  
October 1995

CODE 668/LHEA:HEASARC RESEARCH SCIENTIST

1994 July 1st - September 30th

WORK ACCOMPLISHED AND IN PROGRESS

(i) Science Related

I wrote 2 proposals for ASCA AO-3, and was named as a Co-I on several other ASCA AO-3 proposals: these proposals will be judged in late October at the AO-3 Reviews.

I reviewed 39 proposals submitted to the National Radio Astronomy Observatory (NRAO) for observing time on its facilities, and e-mailed my reports back to NRAO on July 8. I also reviewed 7 proposals for funding that had submitted to the National Science Foundation in July.

The paper by myself, Jeff Linsky [U. Colorado] and Jay Bookbinder [SAO] on the results of a radio survey of non-magnetic, chemically peculiar Am and HgMn stars was accepted by Astronomical Journal, and should appear in the December 1994 issue. The paper by myself, KP Singh (NRC), Nicholas White (GSFC), and Ted Simon (U. Hawaii) on the results of our preliminary analysis of 2 ASCA observations of solar-type stars, originally submitted to Astrophysical Journal Letters on May 23rd, was slightly revised in response to the referee's comments, and was accepted on August 1994. It should be published in one of the November issues of ApJ. A paper by KP Singh, myself, and Nicholas White on ASCA and ROSAT observations of Short-Period Algol Binary Stars was submitted to Astrophysical Journal at the end of September.

I reduced the data obtained in 12.5 hours of VLA observing time in May 1994. These observations included a search for radio emission from very low-mass (VLM) stars and brown dwarf (BD) candidates, and a continuation of my previous survey of magnetic, chemically peculiar (MCP) stars. None of the 17 VLM stars or BD candidates were detected at 6 or 20 cm, suggesting that radio emission (like X-ray emission) is correlated with bolometric luminosity, and that these very low-luminosity objects are very faint radio emitters. 3 of the 6 MCP stars were detected as radio sources at 3.7 cm, confirming the high fraction of strong radio emitters in this class of stars.

I had 2 ROSAT observations scheduled to be made in the period from July 10 thru October 4 1994. I received data tapes in this period for 3 previous ROSAT HRI observations, all of Am stars. These new data included 2 detections, one of an Am + Am binary star in which there is no other known counterpart for the X-ray source, with an X-ray luminosity of  $2.5 \times 10^{28}$  erg per second, about an order of magnitude brighter than that of the active Sun.

(ii) Programmatic

I continued to monitor the anonymous ftp and Gopher services and the ADS access provided by the HEASARC to the scientific community. At the end of September we transferred our database services to a new and hopefully faster computer: the impact was expected to be negligible to our outside users, for whom the transition was essentially invisible.

At the request of the HEASARC Director, Nicholas White, I started

a series of regular meetings for the purpose of co-ordinating more tightly our creation of new HEASARC databases and catalogs that would be accessible via our BROWSE and WWW utilities. I also instituted a tracking procedure to ensure that these new products were created in a timely and prioritized fashion. [See attached list of outstanding projects that I made for this purpose]. This systemization did indeed seem to help our database creators Pat Tyler and Susan Humphrey [both HSTX] accomplish their tasks.

I worked with Laura Whitlock [USAR] and Jesse Allen [HSTX] on a number of new database projects, in the sense of getting them set up in our anonymous FTP area on our Legacy computer, including HEAO-1 A2, HEAO-1 A4, Ariel-5, and Vela-5B.

I continued working with Jesse Allen (Hughes/STX) on our project to complete a FITS database of the Einstein MPC data. We generated an initial version of the FITS files, but discovered a bug in the STOPTIME parameters of these files and decided to recreate them all. Jukebox problems have delayed the completion of this activity, which should be completed by the end of October. A few remaining things that then would still need to be done to complete this activity are discussed in the work planned for next quarter.

The creation of an SSS FITS database is still ongoing: the commencement of the mass processing was further delayed due to a decision to add some additional environmental data to these files that might be useful in data selection. This introduced a new bug in these files which was subsequently corrected by Brendan Perry [HSTX]. Data verification is scheduled to be completed at the beginning of October.

#### NON-LOCAL TRAVEL

I will attend the High Energy Astrophysics Division Meeting of the AAS in Napa Valley in November and give an invited review talk on the subject of X-ray observations of stars.

#### WORK PLANNED FOR NEXT QUARTER

I will prepare the invited review talk on the subject of X-ray observations of stars that I will be presenting at the High Energy Astrophysics Division Meeting of the AAS in Napa Valley in November.

I will review about 70 ASCA AO-3 proposals, serving as primary reviewer of 7 of them, and secondary reviewer on another 7, and attend the AO-3 Reviews to be held in Tyson's Corner, VA on October 24 to 26.

I will work with Pat Tyler and Song Yom [HSTX] to create a BROWSE database that can be used to locate specific MPC observations much more easily than by searching our FTP area. I and Brendan Perry [HSTX] will complete the creation of the new SSS FITS files database; I will then work with Pat Tyler and Song Yom to create a BROWSE database to access these files. I will work with the FTOOLS/XSELECT programmers such as Brian Elza [HSTX] to ensure that we will have appropriate software to operate on both the SSS and the MPC FITS files.

I will continue overseeing the anonymous ftp account on HEASARC's LEGACY computer, as well as the HEASARC's ADS node, and the request@legacy user hotline. I will continue monitoring our creation of BROWSE databases and catalogs.

I and Ian George (USRA) will start work on the creation of a new Einstein TGS database, building on the preliminary work already done by Tim Kallman (LHEA) and Saku Vrtilek (U. Maryland).

Outstanding OLS/Database Tasks and Estimated Completion Dates: Version 5

Original: July 27 1994  
Last Update: September 14, 1994

Summary of Outstanding Tasks

22 New Databases to be created:

of Highest Priority:

EXOHGLS  
IPCDEEP  
EXOGPS  
HRIDEEP  
ZWICKY  
ESOUPP

of Lower Priority:

BATSE  
XRAYPULSAR  
VELA5BRAW  
GAMMARAY  
EUVELOG  
IUELOG  
SSSRAW  
SAS2  
ROSATCENTRAL until we come up with a better name  
EUV  
HIIREGION  
PLANNEB  
CSTARS  
IPCOSTARS  
LXLBOLOSTARS  
MPCRAW

20 out of 29 Databases to be updated, corrected, and/or re-created  
still remain to be done

[See Detailed list at end for fuller description of above items]

OTHER HEASARC OLS ACTIVITIES

- (A) - prepare new versions of the users guides for 09/30/94 Pending  
both the general Online Service/BROWSE  
and the Available Databases for publication  
(and to be made available on the Web)  
\*\*\* PT has comments in & is making new version  
\*\*\* PT will distribute new version for final updates
- (B) - provide alternatives to present nh program to ? Pending  
calculate column density of nh  
\*\*\* SD has submitted request to create nhcolumn db  
\*\*\* SD has contacted Rick Shafer (9/15/94) about COBE nh survey  
\*\*\* and will meet with him in early October  
\*\*\* Eric Perlman and Laurence Jones will be drafted?  
\*\*\* NW suggests meeting of all interested HEASARC parties

- (C) - move database and OLS from Ultrix to OSF 10/03/94 Pending  
 \*\*\* OLS is now up and running on legacypend  
 \*\*\* most data have been moved  
 \*\*\* legacy and legacypend OLS will be run in parallel for 1 month  
 \*\*\* We will mirror only the /FTP/software area  
 \*\*\* legacypend is (at low load) 10-20 times faster than legacy
- (D) - change BROWSE from SQL to INGRES 07/01/95 Pending  
 \*\*\* SY is redesigning data products metabase  
 \*\*\* SY is scheduling sub-group meeting 9/20  
 \*\*\* PJ will be taking current HEASARC tables and  
 \*\*\* moving them frm SQL to Ingres  
 \*\*\* XTEMIPS is to be first prototype of mission db  
 \*\*\* under Ingres: development will start 10/94
- (E) - fix LE PHA and RATES files 10/15/94 ?  
 \*\*\* IG is waiting for next FTOOLS release to fix PHA files  
 \*\*\* LA is to fix RATES files
- (F) - finish cleaning up the CMA database, i.e., 12/31/94 Pending  
 remove spurious detections and make sure the names  
 and classes are correct for each off-axis source  
 \*\*\* big job started but not finished.
- (G) - convert the A2 pointed spectra to 10/31/94 ?  
 fits and add links to them from the A2POINT db.  
 \*\*\* IG action item: The appropriate FTOOLS are now available  
 \*\*\* How to work out pointing info for any specific detector?  
 \*\*\* Need more info from KA  
 \*\*\* JA & LW are working on the light curves
- (H) - finish converting the TGS and TGS2 data files 10/31/94 ?  
 to fits and make sure they are accessible from legacy.  
 \*\*\* IG has created FITS spectral files  
 \*\*\* FITS lightcurve files still need to be done  
 \*\*\* Talk with Fritz Paerels at ASCA Reviews
- (I) - write software to convert the caldb index files 10/31/94 Pending  
 to browse databases so caldb files can be  
 accessed via browse.  
 \*\*\* IG/PT action item
- (J) - ask EXOSAT for ME slew data to turn into SKYVIEW db Indef ?  
 \*\*\* EXOSAT has promised to send us these data
- (K) - check /FTP/ginga/data/LAC to verify that all data files 9/30/94 ?  
 are there; files need keywords TSTART and TSTOP added  
 so that XRONOS can handle them, plus others possibly  
 \*\*\* BP is waiting for input from LA  
 \*\*\* should check new format with OFWG?  
 \*\*\* problem of missing files in present db still unresolved?
- (L)- Ability for users to grab things from anon ftp area and Pending  
 place them in their xobserver area is very restricted: you  
 presently have to ftp: gopher doesn't allow transfers  
 \*\*\* BON was supposed to look into this issue and inform SY

#### APPENDIX: Detailed List of Specific Database Activities

#	Description	Target Date	Completion Date or Status
(4a)-	update bburst database, as present one only goes up to March 1992) *** PT should call Time parameter MJD	9/30/94	?
(4b)-	create a new BATSE database that has 1 or 2 standard light curves accessible *** Available on Mosaic CGRO page *** TM -> PT	10/31/94	?
(5a)-	add to the EGRET (pointing) catalog the link to relevant file that source is found in *** Available on Mosaic CGRO page *** TM -> PT *** no dbhelp for this database *** no link to files as yet	9/30/94	?
(5b)-	create EGRET Source Catalog for BROWSE *** TM -> PT	10/15/94	?
(10)-	make a database with all the X-ray pulsar periods *** Tom Prince -> SH & PT *** TM should lead this effort	long-term	Pending
(13)-	recreate ariel5 database *** SD submitted request to PT on 08/09/94 *** LW should check new version on LHEAVX	09/15/94	Done?
(14)-	create new vela5b_raw database *** do we want this as browsable db? Yes *** if so, we prob need it to be able to *** call ftool to select appropriate files *** that incorporates old FORTRAN code *** LW & JA had to (partly) repeat db creation	09/30/94	Pending
(15)-	recreate fpcs database *** SD submitted request to PT on 08/11/94 *** the pha files may need to be recreated: *** IG will probably need to be heavily involved *** as these are very strange format FITS files	09/30/94	?
(16)-	do final updates to correct fields in SSSHME database	08/12/94	Done
(19)-	make EINLOG a central Einstein database from which all Einstein data products can be found *** wait until backlog of db updates is cleared?	09/30/94	?
(22a)-	update master xray catalog to include all appropriate catalogs *** decide what should be included *** presently has: A2PIC, A3, EMSS, HRICFA, IPC, IPCSLEW, XRBCAT *** could add: A1, A2POINT, A4, BBXRT, LE &/or CMA, FPCS, TGS, SSS	09/30/94	?
(22b)-	create new master GAMMARAY catalog? *** is this useful? Marginally so, it would	09/30/94	?

\*\*\* have 25 COSB, 4 SAS2, & 300 EGRET sources

- (23)- add new EUVELOG catalog 09/30/94 ?  
\*\*\* SD e-mailed Carol Christian at CEA  
\*\*\* SD will contact Alex Brown  
\*\*\* link to EUVE files to be put into  
\*\*\* anonymous ftp?
- (24)- add new IUELOG catalog 09/15/94 ?  
\*\*\* NW will discuss with MvS
- (26)- create new SSSRAW database based on SSSHME to 09/30/94 Pending  
access new SSS FITS database  
\*\*\* when SSS FITS database is finished
- (32)- make a separate database from the EXOSAT CMA 09/30/94 Pending  
for the EXOSAT HGLS (high galactic latitude survey).  
\*\*\* waiting for input from P. Giommi  
\*\*\* See message of Aug 2 1994 plus  
\*\*\* formal db request on same date from NW  
\*\*\* source names will be sent by PG
- (34)- in EXOSAT FOT databases, identify missing FOTS, 09/30/94 ?  
and put RA and Decs into the DB.
- (35)- update the exopubs database (ask estec if they 09/30/94 ?  
are still doing this).  
\*\*\* NW was to check and see if ESTEC were still  
\*\*\* updating their version. PT will check EXOSA0  
\*\*\* and report
- (37)- update the COSB database to point to the new 09/30/94 ?  
events files that have been created.  
\*\*\* BP action item
- (38)- create a SAS2 database and point to associated 09/30/94 ?  
data files.  
\*\*\* BP action item
- (43)- check status of PPM catalog: previously noted bug 09/15/94 ?  
in class parameter,  
\*\*\* Still needs to be copied from Vax to Legacy?  
\*\*\* SH is checking on status
- (45)- ARIEL3A needs dbhelp overview ?  
\*\*\* NW to send info to PT
- (46)- ROSAO needs the addition of the A05 targets ?  
\*\*\* SD notified MD
- (47)- want to create a central ROSAT database ?  
\*\*\* KS action item
- (55)- Fixes to GINGALOG and GINGAMODE line summaries requested by ?  
NW on 08/02/94: for GINGALOG please add "exposure" to the  
line summary, while for GINGAMODE please add LOW\_COUNT\_RATE  
and HIGH\_COUNT\_RATE. In both cases the size of the ACS MONITOR  
field can be reduced (could be renamed to just ACS).



- (59)- Create new EUV Master Catalog per request of SD 09/08/94 ?
- (61)- Create new version of IPC database as per NW request of 8/31/94 Done?  
08/05/94.  
\*\*\* SH finished on LHEAVX on 8/19/94. It looks ok to SD,  
\*\*\* NW should check it over.
- (62)- Create new database IPCDEEP as per NW request of 8/05/94 8/31/94 Done?  
\*\*\* SH finished on LHEAVX on 8/31/94.  
\*\*\* It looks ok to SD, should be copied to Legacy after  
\*\*\* NW checks it over
- (63)- Create new database HIIREGION as per NW request of 8/05/94 9/15/94 ?
- (64)- Create new database PLANNEB as per NW request of 8/05/94 9/15/94 ?
- (65)- Create new database CSTARS as per NW request of 8/05/94 9/15/94 ?
- (68)- Add description on dbhelp for ROSAO on parameters category 9/15/94 ?  
as per NW request of 8/08/94. SD suggests:
- Subject Category of source according to PI:
- 1 - normal stars
  - 2 - white dwarfs
  - 3 - cataclysmic variables
  - 4 - neutron stars, black holes
  - 5 - supernova remnants
  - 6 - normal galaxies
  - 7 - AGN
  - 8 - clusters of galaxies
  - 9 - diffuse X-ray emission
  - 10 - other
- (69)- Create new database EXOGPS as per NW request of 8/11/94 9/30/94 ?
- (70)- modify ASCAO to delete 32 extraneous unobserved sources 9/15/94 ?  
as per SD request of 8/11/94
- (71)- Create new database HRIDEEP as per NW request of 8/05/94 9/30/94 ?
- (72)- Create new database ZWICKY as per NW request of 8/31/94 9/30/94 ?
- (73)- Create new database ESOUPP as per NW request of 8/31/94 9/30/94 ?
- (74)- Create new database IPCOSTARS as per MC request of 8/31/94 10/15/94 ?
- (75)- Create new database LXLBOLOSTARS as per MC request of 10/15/94 ?  
8/31/94
- (76)- Correct error in declinations in PMN catalog as per 9/15/94 Done  
user complaint 09/02/94 (seconds of declination are  
always 00 in database)
- (78)- Create new MPC\_RAW database as per SD request of 9/09/94 9/30/94 ?
- (79)- Create new db NHCOLUMN as per SD request of 09/15/94 10/31/94 ?

UNIVERSITIES SPACE RESEARCH ASSOCIATION  
GODDARD VISITING SCIENTIST PROGRAM

QUARTERLY TECHNICAL REPORT  
1994 Jul 01 - 1994 Sep 30

Employee Name: Ian M George

Activity: 5030-01A-39

Programatic Activities

Caldb Infrastructure & Access

My programatic responsibilities continue to be dominated by the maintenance & development of the *OGIP Calibration Database*, an on-line database designed to contain calibration files for all instruments for which the OGIP is responsible for supplying scientific data. Calibration datasets & documentation continue to be delivered by the various instrument teams and Guest Observer Facilities (GOFs) of current mission, as well as by HEASARC personnel responsible for the restoration/conversion of data from old mission.

On-line access to the entire database continues to be provided via the `legacy.gsfc.nasa.gov` computer, and available world-wide via anonymous ftp, gopher, WWW *etc.* As of 1994 Sept 24, the total size of database was 1.7 Gbyte, dominated by 1.0 Gbyte of data files and 0.6 Gbyte of documentation. The number of files taken from the database per month continues to be somewhat erratic, in most cases reflecting the erratic delivery of files from the hardware teams and the pseudo-immediate copying of these new datasets by users (Figure 1).

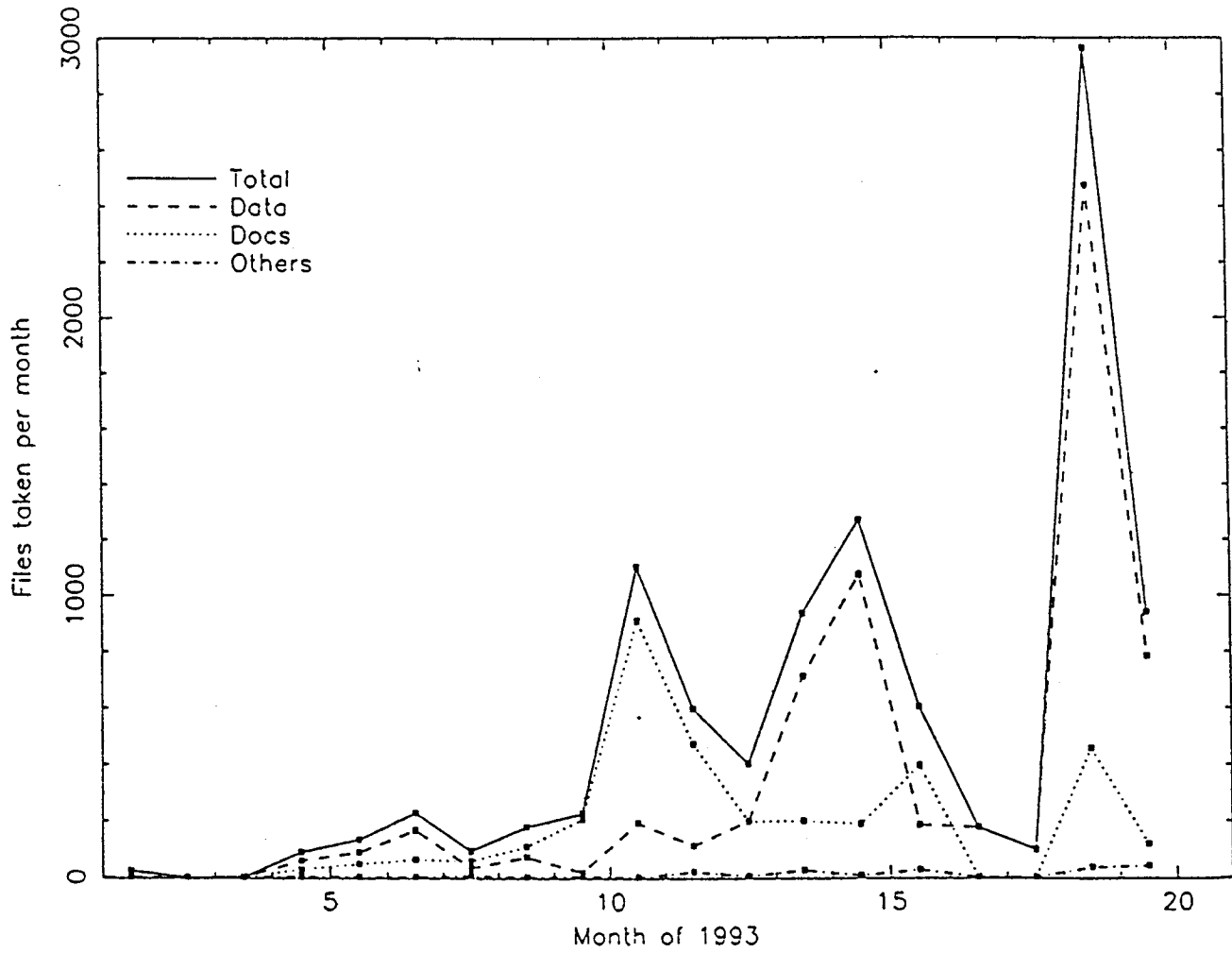
FTOOLS s/w

My responsibilities regarding FTOOLS s/w tasks has mainly been dominated by the addition of enhancements and fixing of a few (relatively minor) bugs in the tasks for which I'm responsible. No new tasks were contributed by myself in the last few weeks, although I have played a significant role in the design and develop of a number of *ROSAT*-related tasks written by STX personnel. At least 3 new tasks are due to be written by myself and delivered for distribution in the next quarter (see below).

FITS File Formats

I have continued to serve as the secretary of the OGIP FITS Working Group (OFWG). However there seems to have been little activity in the development of OGIP FITS file formats over the past quarter. I continue to maintain the OFWG-related ftp and WWW areas, and a regular article for the HEASARC's journal *Legacy* was prepared listing the OFWG's recommendations over the period 1993 Sept - 1994 Aug.

CALDB FILES TAKEN (via anon ftp, excluding LHEA users)



GEORGE 19-SEP-1994 15:41

## Personal Research Activities

This quarter has been fairly productive in terms of my personal research activities, mainly due to the arrival of *ASCA* AO-1 datasets.

In collaboration with Turner & Shrader (USRA), Nandra & Fabian (IoA, Cambridge, UK), Sun (Taiwan, ROC), Balucinska-Church (Univ Birmingham, UK), Gondahalekar (RAL, UK), Malkan & Rush (UCLA), and Stone (Lick Observatory), I have completed a preliminary draft of a paper reporting the results from a *ROSAT* PSPC AO-3 monitoring campaign, a recent *ASCA* observation, along with a very large set of *IUE* and optical archival data on the Seyfert-1 galaxy Mrk 841. Work continues (albeit slowly) to prepare this paper for publication.

In collaboration with Turner (USRA) and Netzer (Tel Aviv, Israel) a paper has been submitted for publication which reports the discovery of an OVII emission line in the *ASCA* spectrum of the Seyfert-1 galaxy NGC 3783. This feature (at  $\sim 0.6$  keV) is predicted in a number of models which we have been pursuing to explain the physical conditions which this and other "warm absorber" sources and hence is very reassuring.

In collaboration with Turner, Madejski (USRA), and Kitamoto, Suzuki (Osaka Univ, Japan) a paper has been submitted for publication reporting the results from *ROSAT* and *ASCA* observations of the Flat-Radio Spectrum (FRS) quasar NRAO 140. We confirm that the (historically variable) X-ray absorption along the line-of-sight to the source exceeds that implied by 21 cm observations for this distant object ( $z = 1.258$ ). Unfortunately however the X-ray data along do not allow us to determine the location of the absorber (whether it is intrinsic to NRAO 140, in an intermediate system etc), however we suggest that the absorber is most likely due to AU-scale structure in the (Galactic) Perseus molecular cloud.

## Papers Published/Accepted (in quarter ending 1994 Sept 30)

(NOTE: Due to the long turn-around time taken for papers submitted to refereed journals, most of the following scientific papers will have appeared in earlier quarterly reports as submitted/not accepted papers.)

### *Refereed Journals:*

1. The UK Deep and Medium Surveys with *ROSAT*: Log N – Log S  
Branduardi-Raymont, G., Mason, K.O., Warwick, R.S., Carrera, F.J., Mittaz, P.D., Puchnarewicz, E.M., Smith, P.J., Barber, C.R., Pounds, K.A., Stewart, G.C., McHardy, I.M., Jones, L.R., Merrifield, M.R., Fabian, A.C., McMahon, R. Ward, M.J., George, I.M., Jones, M.H., Lawrence, A. & Rowan-Robinson, M.  
1994. *Mon. Not. R. astr. Soc.*, in press.
2. Multi-wavelength Monitoring of the BL Lac Object PKS2155-304.  
IV. Multi-Wavelength Analysis  
Edelson, R., Krolik, J., Madejski, G. Maraschi, L., Pike, G., Urry, C.M., Brinkmann, W., Courvoisier, T.J.L., Ellithorpe, J., Horne, K., Aller, H.D., Aller, M.F., Ashley, M., Begelman, M., Blecha, A., Bouchet, P., Bratschi, P., Bregman, J.N., Carini, M., Celotti, A., Donahue, M., Fiegelson, E., Filippenko, A.V., Fink, H., George, I.M., Glass, I., Heidt,

- J., Hewitt, J., Hughes, P., Kollgaard, R., Kondo, Y., Koratkar, A., Leighly, K., Marscher, A., Matheson, T., Martin, P.G., Miller, H.R., Noble, J.C., O'Brian, P., Pian, E., Reichert, G., Saken, J.M., Shull, J.M., Sitko, M., Smith, P., Sun W.-H., Tagliaferri, G., Treves, A., Wagner, S., Wamsteker, W. & Warwick, R.S.  
1994. *Astrophys. J.*, in press.
3. X-ray Color Analysis of the Spectra of Active Galactic Nuclei  
Netzer, H., Turner, T.J. & George, I.M.  
1994. *Astrophys. J.*, in press.
  4. A snapshot of the continuous emission of the active galactic nucleus in NGC3783 from gamma-ray to radio wavelengths  
Alloin, D., Santos-Lleo, M., Peterson, B.M., Wamsteker, W., Aitieri, B., Brinkmann, W., Clavel, J., Crenshaw, D.M., Evans, I.N., George, I.M., Glass, I.S., Johnson, W.N., Kriss, G.A., Malkan, M.A., Netzer, H., Polidan, R.S., Riechert, G.A., Rodriguez-Pascual, P.M., Romanishin, W., Starr, C.H., Stripe, G.M., Taylor, M., Turner, T.J., Vega, H., Winge, C. & Wood, D.O.S.  
1994. *Astron. Astrophys.*, in press.
  5. Soft X-ray and Ultraviolet Observations of Mrk 841: Implications for the Blue Bump  
Nandra, K., Turner, T.J., George, I.M., Fabian, A.C., Shrader, C. & Sun, W.-H.  
1994. *Mon. Not. R. astr. Soc.*, in press.
  6. The X-ray Spectrum of the Highly-Polarized Quasar PKS 1502+106  
George, I.M., Nandra, K., Turner, T.J. and Celotti, A.  
1994. *Astrophys. J. Letts*, in press.

*Non-Refereed Journals, Conference Proceedings etc:*  
None

*Other Articles:*

1. Recommendation of the OGIP FITS Working Group 1993 Sept – 1994 Aug  
George, I.M.  
1994, *Legacy*, 5, in press.
2. Recent Updates to GRPPHA  
Yusaf, R. & George, I.M.  
1994, *Legacy*, 5, in press.

Papers Submitted, not yet accepted by Refereed Journals:  
(in quarter ending 1994 Sept 30)

(As above, the long turn-around time taken for papers submitted to refereed journals, will result in most of the following scientific papers appearing in more than one quarterly report.)

1. The Discovery of an OVII Emission Line in the ASCA Spectrum of the Seyfert Galaxy NGC 3783  
George, I.M., Turner, T.J. and Netzer, H.  
1994. *Astrophys. J. Letts*, submitted.
2. ASCA and ROSAT Observations of NRAO 140 and IX Per  
Turner, T.J., George, I.M., Madejski, G.M., Kitamoto, S., and Suzuki, T.  
1994. *Astrophys. J.*, submitted.

### Non-Local Travel

None

### Work Planned for the period 1994 Oct 01 – 1994 Dec 31


Projected activities for the next quarter include:

- design, development and delivery of 3 FTOOLS tasks:
  - COL2IMG - tool to produce a FITS image from a 3-dimensional collimator response file (X,Y,Energy) over a user-defined energy-range
  - PCAFOV - a tool to combined user-defined 3-dimensional collimator response files from individual XTE PCUs, correcting for known/assumed boresight offsets between the individual PCUs (in collaboration with the XTE PCA Team, and XTE GOF)
  - FAKEPHA - a tool to fold a user-defined spectrum through a detector response matrix and produce a PHA spectrum.
- continued review & development of FITS file formats via the OFWG
- continued scientific analysis and publication of recently obtained *ROSAT*, *ASCA* and *IUE* datasets

Progress Report 1 July - 30 September 1994

Task # 5030 - 01A-39

Laura A. Whitlock, Ph. D.



### Programmatic

With Dr. Eric Gotthelf (USRA), Dr. Penny Haskins (Rad. Tech., Inc.), and Jesse Allen (HSTX), cleaned the corruption from the Vela 5B data. The coordinate-ordered data were then converted into FITS and put online to allow community access. An FTOOL is now under development (with Dr. Emily Greene (HSTX)) for easy access to the data in the new format. Additionally, work has begun to convert the time-ordered data base into FITS.

With Jesse Allen (HSTX), used the DSDISK data base created long ago by Dr. Frank Marshall (NASA-GSFC) and the software created by Dr. Keith Jahoda (NASA-GSFC) to make 2864 maps using the data from the HEAO 1 A-2 experiment. We had originally thought that only 16 maps would be created, but the project grew by leaps and bounds. These have been put into FITS and will go on-line in October. Work will then begin on putting other data products, as well as the raw data, from this experiment into FITS and on-line on Legacy.

With Brendan Perry (HSTX), developed a plan to get the HEAO 1 A-1 pointed data off tape in a non-standard format and into FITS. We have finally decoded the bytes in the data records (recall we had no byte map to tell us what was what), and will start creating the FITS files in October. There are some 325 pointings for which we have the data files.

With David Dawson (HSTX), began work with the data from the Cosmic X-ray Spectroscopy Experiment data from the OSO 8 satellite. Much of the data and programs relating to this data were written for either the old IBM mainframe or the old PDP1170 computer. Neither of which are of much help today. The going is slow, but we are working toward producing lightcurves and spectra for some 100 sources seen by this instrument by the end of the year.

Continued to provide support to Dr. Ron Remillard of MIT to reformat the HEAO A-3 data. He is changing the data formats from the old Data General to UNIX. In doing so, he has found many old 800 bpi tapes which he cannot read on his machine. He sends these to me, I recover the data from them and mail him back something he can read and convert. This effort is now complete. Discussions of "what to do next" to make this data useful to the general community have begun.

Continued to provide support to Dr. Richard Shubert (U. Cal-Fullerton) in his research on the cosmic background analysis of the Vela 5B data. He had to start over with his data analysis due to the corruption I discovered in the Vela 5B data. I am helping him reanalyze the data, since I can do it much faster than he can over the network.

## Science

The science effort for my current ADP grant spent much of this quarter at a halt while the corruption found (see last quarter's report) was cleaned out. Dr. Eric Gotthelf (USRA) and I did take the time to do a brief presentation at the 1994 COSPAR meeting in Hamburg, Germany in July on what we had found so far in this project.

## Other

Submitted proposals to the ASCA AO3 announcement. These were primarily reworks of previously rejected proposals, although we did pick up some new collaborators on the Circinus X-1 effort.

"Taking a Different Look at Circinus X-1: A Violent Runaway in Quiescence"  
L. Whitlock, N. Brandt (Cambridge U.), T. Dotani (ISAS), J. Lochner, E. Gotthelf

"A Study of the Iron Line Emission of Scutum X-1"  
J.C. Lochner, L.A. Whitlock, L. Cominsky (Sonoma St. U.), N.E. White (NASA),  
E.V. Gotthelf, and R.Kelley (NASA)

"Is 4U1907+09 a Non-Aligned Supergiant Binary"  
Lynn Cominsky (Sonoma State U.), L.A. Whitlock, E.V. Gotthelf, J.C. Lochner,  
N.E. White (NASA)

"X-Ray Spectroscopy of the Be/X-Ray Binary GX304-1"  
Richard L. Kelley (NASA), S.S. Holt (NASA), J.C. Lochner (USRA), Caroline  
Stahle (NRC), L.A. Whitlock(USRA), Fumiaki Nagase (ISAS), L.Cominsky (SSU)



1994 3rd Quarter Report  
M. F. Corcoran (5030-02A-39)

1.

To: Crystal Wheatley  
From: Dr. M. F. Corcoran  
Activity: 5030-02A-39  
Subj: 3rd Quarter Technical report, 1 Jul 1994 - 30 Sep 1994  
Date: 30 Sep 1994

PROGRAMMATIC ACTIVITIES ACCOMPLISHED

1) ROSAT public archive

a) Supervision of data ingest into the NDADS archive is continuing, In this quarter 185 US ROSAT datasets and 385 German/UK ROSAT data sets were released to the archive.

b) Public ROSAT data sets have been moved to the HEASARC jukebox attached to the legacy machine. Routines to move data from NDADS staging area to legacy jukebox were designed, written, tested and implemented. In this quarter this included all data released to NDADS during this quarter.

c) the ROSAT archive data lists have been updated to reflect recent ingests.

d) Number of e-mail communications during this quarter: 627, including user comments, data release and archive maintenance communications.

e) Preliminary design plans for the ROSAT Results Archive (RRA) were drawn up by GSFC and SAO for the HRI and by MPE and Pottsdam for the PSPC. I attended a meeting at MPE in Sep to discuss these plans and how best to implement the RRA. Agreements were reached as to the types of quality checking to be done and a basic implementation strategy.

2) Rationalized FITS development for ROSAT

a) supervision of the development of the RDF software continued. Bug fixes and enhancements continue. RDF 3.0, released during this quarter, incorporates light curves for the PSPC and uses an improved method for handling anomaly conditions.

b) Number of e-mail communications during this quarter concerning rationalized FITS development: approximately 290

3) OGIP FITS working group

a) The OFWG has continued roughly bi-weekly meetings to discuss FITS issues in the OGIP.

b) number of e-mail communications regarding FITS issues: 75

c) I presented a poster describing the OFWG at the 1994 ADASS meeting.

4) RGOF duties

a) The RGOF continued its series of bi-weekly meetings

b) number of e-mail communications regarding RGOF issues: approximately 143, including user questions and internal RGOF issues.

5) Software Development

a) I wrote and tested a routine to extract information about archived data sets from the public contents files produced with each archived data set to allow for much faster updates to the archive data tables in BROWSE and MIPS.

**1994 3rd Quarter Report  
M. F. Corcoran (5030-02A-39)**

2.

b) I wrote and tested a routine to update the RDF source table file with columns and header information which will be used during the quality checking phase of the RRA construction.

c) I wrote and tested a prototype graphical user interface to allow for quick checking of source reliability as part of the quality checking phase of the RRA construction.

**TRAVEL**

- 1) Attended a data center meeting held at MPE to discuss RRA issues, Sep 1994.
- 2) Attended ADASS meeting in Baltimore and presented poster, Sep 1994.

**PAPERS ACCEPTED**

"ASCA Solid State Imaging Spectrometer Observations of O Stars", M. F. Corcoran, W. L. Waldron, J. J. MacFarlane, W. Chen, A. M. T. Pollock, K. Torii, S. Kitamoto, N. Miura, W. Egoshi, and Y. Ohno, ApJL, submitted.

**GRADUATE STUDENT SUPERVISION**

I supervised U Md grad student Sven Geier in his analysis of my Sco OB1 ROSAT PSPC observations. A paper is forthcoming.

**PROPOSALS SUBMITTED/AWARDED**

1 ASCA AO3 proposal was submitted with me as PI. I was Co-I on 2 other ASCA AO3 proposals.

**PLANNED ACTIVITIES**

- 1) Continue supervision of ROSAT Public Archive including ingest of WG data.
- 2) Finish development of rationalized FITS calibration data files.
- 3) Continue guest observer support activities
- 4) Continue development of RRA.
- 5) Publish results of analysis of ROSAT observations of Carina Nebula, V444 Cyg and BBXRT data of Zeta Ori.
- 6) Write draft of paper summarizing work on Sco OB1
- 7) Begin analysis of Cyg OB2 ROSAT PSPC observation.

Dr. Steven L. Snowden  
USRA Quarterly Technical Report  
Task Number: 5030-02A-39  
1 June – 30 September 1994  
Code 666, Laboratory for High Energy Astrophysics  
*ROSAT* Guest Observer Facility

22 September 1994

### Programmatic Work

The software which I discussed in the previous quarterly report for the analysis of *ROSAT* PSPC observations of extended sources and the diffuse X-ray background has been officially released to the public. The response has been very positive with use being made of the software by GOs both at the GOF and at other institutions. I am continuing to improve the documentation and have been responsive to suggestions from users. I have created new software to allow the merging of multiple pointings and am entering the beta-site testing phase for this extension to the original package.

I have also been working on a version of the software which will provide exposure correction and background subtraction for HRI observations. This is becoming more vital as the HRI become the only operating instrument. In addition, several accepted proposals from the last AO will require this capability.

The *ROSAT* Users' Handbook is very close to official release with only a few figures remaining to be upgraded. While the RUH is not yet a finished document (and won't be until the mission is ended), it is an extensive and useful guide to both mission operations and calibration status, as well as providing an extensive description of the scientific instruments. After being the US editor for the RUH and having had extensive input into its present form, I take a fair amount of pride in its present status.

The reduction of *ROSAT* trend data (diagnostic information for both the PSPC and HRI in more useful format) continues in production mode. Changes in the SASS output has required reprocessing but this continues and is functioning well. Documentation is being prepared for an official release to the community. The trend data has already proved very useful in the particle background calibration of the HRI.

### Scientific Work

This quarter I've had two lead-author papers accepted for publication and one which appeared in print. "*ROSAT* Observations of the Eridanus Soft X-ray Enhancement" has been long in the making but "An X-ray Image of the LMC" was submitted on 21 July and was accepted on 13 September. Work continues on a paper presenting the diffuse background data from the *ROSAT* all-sky survey.

My work with the summer graduate student from the University of Maryland went very well, and was a pleasure. We are now preparing a paper for submission to the *Astrophysical Journal* based on our analysis of the shadowing of diffuse X-ray emission by galactic molecular clouds. My work with the teacher intern from PG county also was a very positive experience. We remain in contact and will collaborate in bringing select students to visit LHEA.

### Plans for the Next Quarter

The next quarter will be an extremely busy one. Besides continuing work on projects

listed above, in October I will visit Leicester University for discussions about *ROSAT* software and the calibration of the PSPC. From Leicester I will continue on to Munich where I will represent the USRSDC at the MPE *ROSAT* meeting and have additional discussions about *ROSAT* documentation, calibration, and software. Immediately upon returning from Germany, I will attend the AAS HEAD meeting to both participate in the *ROSAT* Workshop and present a scientific paper. In addition, I will be chairman for the oral session on the interstellar medium.

# QUARTERly REPORT for July 1- SEPT 30th 1994

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T.JANE TURNER

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## Project Support

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I am currently involved in writing a cookbook for ROSAT analysis using the new xselect/ftools. The cookbook will be distributed at the November HEAD meeting.

I am continuing to work on analysis of PANTER ground calibration data (from the engineering model of the PSPC). The new data were required to investigate the energy response of the PSPC when operated at different high voltage settings than originally planned. Modifications are now required to generate appropriate photon redistribution matrices which describe the energy response of the PSPC.

Have been working with visiting Guest Observers and at the moment handle typically 3-4 email/phone queries per day on ROSAT issues. A significant amount of time is spent answering email and phone queries on data analysis issues and software problems.

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## Scientific Interests

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### Analysis of ASCA observations of NRAO140.

T.J.Turner, I.M.George, G.M.madejski, S.Kitamoto & T Suzuki

We report the results of ROSAT and ASCA observations of NRAO 140 in 1992 and 1994. We confirm that the (historically variable) X-ray absorption along the line-of-sight exceeded that implied from 21-cm during both observations. Whilst the X-ray data alone do not allow us to determine the redshift of the absorber, information from other wavebands suggests the absorption is most likely Galactic, possibly due to AU-scale structure in the Perseus molecular cloud.

The ASCA spectrum of NRAO 140 is well fitted by a power law of energy index  $0.73 \pm 0.03$ , and also yields the tightest constraint to date on Fe K-shell emission, with 90% confidence upper limits of 38 and 31 eV for a narrow line at a rest-frame energy of 6.4 and 6.7 keV respectively. This, along with a lack of hardening towards higher energies suggests that either NRAO~140 is devoid of cold reprocessing material, the reprocessing material has a geometry in which the imprinted features are weak, and/or the X-ray emission is relativistically beamed towards us.

\*This paper was submitted to ApJ September 7th 1994\*

Multiwaveband observations of Mkn841

PI is Dr. Ian George, collaborators are A.C.Fabian and K. Nandra at Institute of Astronomy, Cambridge, U.K., and Matt Malkan at University of California, LA.

We have obtained numerous ROSAT PSPC observations of Mkn841, with simultaneous IUE and optical observations, over the mission lifetime. We are currently analysing those data, and attempting to interpret them in the light of current popular models for active galaxies, with discussion of the applicability of accretion disk models to the data. WE recently made a huge amount of progress on this paper when Dr Malkan and Dr. Nandra visited GSFC (mid May).

The Discovery of an OVII emission Line in the ASCA Spectrum of The Seyfert Galaxy NGC 3783

I.M.George, T.J.Turner and H. Netzer

We report the first observation of an OVII 0.57 keV emission line in NGC~3783, as predicted to originate in warm absorber systems.

\*This paper was submitted to ApJ Letters in September 1994\*

Analysis of ASCA observations of Mkn290.

The ASCA data for Mkn290 have just arrived, and I am in the process of analyzing them. A quick -look analysis shows a complex soft X-ray spectrum, further work is required to determine whether this is due to the presence of partially ionized absorbing material, or whether we are seeing a second X-ray continuum emission component.

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Work Planned for the Next Quarter

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Work on the World Wide Web pages for the ROSAT project. As Mary Odell is leaving the GSFC group, her WWW work is being split amongst the projects. I will be updating and maintaining the ROSAT area as of Sept 23rd 1994.

Complete the XSELECT/FTOOLS cookbook in time for the HEAD meeting

Participate in producing and testing a new response matrix for the ROSAT PSPC.

Complete the ASCA analysis of Mkn290

Complete the Mkn841 project with Drs. George et al (see above)

Pursue analysis of the ROSAT observations of bright EUVE Seyfert Galaxies

# TECHNICAL REPORT FOR July 1 TO September 30, 1994

Ken Ebisawa (Research Scientist )  
Activity: 5030-03A-39  
code 668, ASCA Guest Observer Facility  
Office of Guest Investigator Program  
Laboratory for High Energy Astrophysics, NASA/GSFC

## PROJECT WORK

- Tested and verified two ASCA analysis programs, *temp2gain* and *timeconv* written by Mrs. Kubo and Hirayama respectively in the Japanese ASCA team, so that they conform to the ASCA GOF software standard. The former was implemented to the ASCA data processing at GSFC, and the latter was publicly released as a FTOOL to ASCA guest observers.
- Modified the *mkfilter2* program, which produces a filter file used for ASCA data cleaning, so that the filter file contains GIS high voltage monitor information, which was missed in the original one written by Dr. Takeshima. The new *mkfilter2* was implemented in the ASCA data processing system at GSFC.
- Helped making four ASCA observation plans for US ASCA Guest Observers.
- Reading 71 ASCA AO3 proposals and assessing their technical feasibility toward the proposal review on October 24 – 26.

## RESEARCH

- Analyzed ASCA data of Cyg X-1. The draft of the paper is being prepared.
- Invited talk at the 30th COSPAR meeting on July 18th at Hamburg, Germany with the title of "X-ray Energy Spectra of Cyg X-1"
- Submitted two ASCA AO3 proposals as a principle investigator. Additionally, involved in four other ASCA proposals as a co-investigator (see blow).
- Invited seminar at the Northwestern University on September 29, with the title of "Spectral Study of Black hole candidates with GINGA and ASCA" . Subsequently, worked with Dr. David Grabelsky at the Northwestern University on GINGA/OSSE simultaneous observation data in September 1991.
- *Papers Published:*

- White, Arnaud, Day, Ebisawa, Gotthelf, Mukai, Soong, Yaqoob and Antunes,  
“An ASCA Observations of One Orbital Cycle of AR LAC”, Publication of the Astronomical Society of Japan, 1994, PASJ, 46, L97
- Fukazawa, Makishima, Ebisawa, Fabian, Gendreau, Ikebe, Iwasawa, Kii, Mushotzky, Ohashi, Otani, Ricker, Tanaka, Ueda and White  
“A Fluorescence-dominated X-ray Spectrum of the Spiral Galaxy NGC6552”, 1994, PASJ, 46, L141
- Ebisawa et al.  
“Spectral Evolution of GS1124-68 (Nova Muscae 1991) Observed with GINGA”, 1994, PASJ, 46, 375
- *Proposals Accepted:*
  - Ebisawa, K. et al. “Verification of the Gamma-ray Pulsar Hypothesis of 2CG333+01 / 1E161348-5055.1 in the SNR RCW103” for GRO Cycle 4
- *Proposals Submitted:*
  - Ebisawa, K. et al. “Spectral Study of the Super Soft Sources CAL87 and RXJ0925.7-4758” for ASCA AO3
  - Ebisawa, K. et al. “Soft X-ray Study of an Extraordinary Black Hole Candidate GRS1915+105 Showing Relativistic Jets” for ASCA AO3
  - Tanaka et al.  
“Study of Iron Line in the Soft (High) State of GX339-4” for ASCA AO3
  - Dotani et al.  
“Simultaneous Observation of the Predicted Outburst of GX339-4 in March 1995 with ASCA and BATSE ” for ASCA AO3
  - Dotani et al.  
“Simultaneous Observation of Black hole Candidates LMC X-3 and X-1 with OSSE ” for ASCA AO3
  - Kelly et al.  
“Orbital-Pulse Phase Resolved Iron Line Spectroscopy of Cen X-3” for ASCA AO3



**Technical Report July 1–September 30 1994**  
**Koji Mukai (Task number: 93-03-00)**

**ASCA matters:** During this quarter, all ASCA GOF scientists, myself included, spent a large amount of time supporting the community in preparing observing proposals for ASCA AO-3. Since this is the third AO in a little over a year, most were in the nature of requests of clarifications over some fine points in the NRA guidelines and ASCA data quality. In addition, I acted as occasional liason between USRA (Crystal Wheatley) and USRA scientists in building 2.

I was on duty in August to help US PIs plan their observations, for a two-week period in the long-term timeline. For some observations, this is trivial; however, my responsibilities included a bright, extended cluster of galaxies and the bright X-ray binary, Her X-1, both of which are difficult to plan for different reasons. Consequently, this activity probably took 7 or 8 working days of my time over a 3-week period.

With the date for the opening of ASCA archive approaching rapidly, the design and testing of Rev 1 processing system have started in earnest. My particular contribution was over mkfilter2, an important part of the processing originally written in Japan by Dr. Takeshima of Riken. For various reasons, Dr. Takeshima is no longer actively supporting the software (apart from occasional consultation), and I became responsible for maintainance together with Dr. Ebisawa (in later stages) and programming help from Dr. Greene (Hughes STX). Updating and testing of mkfilter2 was a major activity during this quarter.

**Science:** I was heavily involved in the completion of a paper by Dr. Gotthelf (with Dr. White and myself as active co-authors; the other co-author, Dr. Jalota, is no longer at GSFC) on an ASCA observation of the Castor system. There are two sources separated only by 1 arc min, which makes the analysis very challenging. This paper has since been accepted by ApJ Letters.

In August, I concentrated on writing two ASCA AO-3 proposals as PI as well as helping to write others as a co-I.

In September, I visited University of Leicester (England) for two weeks, to analyze ASCA data on CVs with Dr. Osborne (Leicester) and Dr. Ishida (ISAS, visiting Leicester at the same time). We have made much progress on EF Eri, and the experience gained there will help our future collaborations on AM Her and others. A paper on EF Eri is in an advanced stage of draft.

**Next quarter:** ASCA AO-3 proposal review will be held Oct 24–26 at Tyson's Corner, VA. The HEAD meeting at Napa Valley is also expected to generate some work, although I will not be attending; there will also be preparatory works for the AAS meeting in Tucson (Jan 8–12, 1995).

**James Lochner**  
**LHEA Office of Guest Investigator Programs**  
**Code 668.0**  
(Activity 5030-04A-39)

**3rd Quarter Report, 1994**

This quarter was spent continuing to develop materials in preparation for the release of the call for proposals for XTE observations, which is due at the end of November, 1994. This includes both working on the document describing XTE, and on software to perform simulations of XTE observations. I also resumed discussions with the instrument team at MIT which is building the XTE All Sky Monitor concerning the archival data from that instrument. I also continued the research project with Mr. Warren Focke and Dr. Jean Swank on shot noise models for Cygnus X-1.

Much of my time this past quarter was devoted to assisting in the writing of the technical appendix for the upcoming NASA Research Announcement calling for observing proposals using XTE. I took the lead in developing a set of examples to be included in the appendix. Because of the multitude of possible data modes which may be used for PCA observations, we developed a set of examples which will give proposers guidelines for choosing appropriate data modes for typical sources. GOF, PCA and HEXTE team members were assigned specific examples to work out. I reviewed the results, modified them appropriately as necessary, and incorporated them into a narrative text.

I also participated in reviewing the various parts of the NRA materials. In particular, I followed carefully the development of the HEXTE Instrument Description and the HEXTE Feasibility chapters written by Phil Blanco (UCSD) of the HEXTE team. I also reviewed the chapters devoted to the PCA, and responded when asked for detailed guidance. In both cases I gave guidance and comments which resulted in material appropriate (in topics covered and depth of detail) for proposers who will not start with much knowledge about XTE.

Another large part of my activity this quarter was spent enhancing the timing simulation tools which will be made available to proposers for developing their XTE observations. These tools, developed within the OGIP's FTOOL environment, were initially delivered this past spring, and include tools for creating fake light curves, and imposing sinusoidal and shot noise signals on existing light curves. The enhancements I have developed this quarter include: data sampling from a typical XTE orbit (including occultations of the source due to earth occultation, and data losses due to XTE's passage through the South Atlantic Anomaly); data sampling from one HEXTE

cluster (i.e. 32 s on source, 32 s off source); allowing the user to specify a non-sinusoidal periodic function to add to an existing light curve; adding a shot model whose behaviour mimics quasi-periodic oscillations seen in some galactic x-ray sources. In addition, I made minor corrections to the algorithms and code. These enhanced tools will be included in the FTOOLS released currently scheduled for late Oct. 1994. The tools will be made available to proposers through the FTOOLS package or as stand-alon executibles.

Late in the quarter, I resumed discussions with the team at MIT which is developing software for the XTE All Sky Monitor. This coming quarter will see further development in the definition of the FITS file format for the ASM data base, a schedule for the interfacing of MIT software with elements of that data base, and (hopefully) prototypes of that software. A new aspect will be elements of the ASM calibration data files.

During this quarter, I continued the collaborative work with Dr. Jean Swank (GSFC) and Mr. Warren Focke (Univ. Md) on development of shot models for Cyg X-1. Mr. Focke is examining Ginga data of Cyg X-1 for the character of the shot process. Together, we hope to be able to develop techniques which would distinguish among two currently debated representations of the shot model: whether all the shots have the same lifetime or whether there exists a distribution in the lifetimes of the shots. During this quarter we started investigating a "matching pursuit" technique, which is described in Mallat & Zhang, 1993, "Matching Pursuits with Time-Frequency Dictionaries", IEEE Transactions on Signal Processing, 41, 3397. This technique characterizes a time series by fitting a set of pulse profiles to the data. The pulse profiles may be stretched in time and amplitude, resulting in a "dictionary" of pulses which make up the time series. Using software provided by Mallet & Zhang, we have performed test analysis on shot noise light curves and the Ginga Cyg X-1 data. The next step is to introduce pulse profiles which are more physically realistic for Cyg X-1 than those provided in the software package. Our preliminary results will be presented at the AAS High Energy Astrophysics meeting in early Nov.

Universities Space Research Association  
High Energy Astrophysics Program  
Technical Report  
3<sup>rd</sup> Quarter 1994

Arnold H. Rots  
Task number: 5030-04A-39

6 October 1994

## 1 XTE-SOC

### 1.1 XFF

Work on XFF has continued at a slightly slower pace than in previous quarters and concentrated on three areas.

It was decided to tie the generation of FITS template files for spacecraft data in with the Project Database (PDB). Work is on-going on the FITS template builder to achieve this goal, as well as combining the extraction of information for XFF from the PDB with that for the Data Management subsystem, to ensure consistency.

The decision was made not to use unsigned integers in XTE FITS files. This has necessitated some design changes and extra coding.

Finally, the design of the FITS database and its related directory tree structure was finished. This part of the project takes much of the burden off the XTE Science Data Center (XSDC, Code 631).

## 1.2 NASA Research Announcement

I have actively participated in the development of the Technical Appendix to the XTE NRA which is due to come out this fall. The work on `recommd` was part of this effort.

## 1.3 EDS Configuration Selection Assistant (`recommd`)

I completed the development of an intelligent EDS configuration selection assistant, named `recommd`. To provide context, let me quote the following four paragraphs from last quarter's Technical Report.

"The EDS (Experiment Data System, developed by MIT) which processes the science data from PCA and ASM before inserting them in the telemetry, is a complicated piece of hardware and software that allows observations to be formatted in hundreds of different configurations. Although the underlying design is fairly simple, its intricacies will not be grasped readily by a casual guest observer. As such, it has indeed raised questions in the project.

"Since the design is not that hard to understand, and it is only the sheer numbers (which, by the way, are needed to cover the full range of X-ray sources) that make it difficult to obtain a clear view of the problem, it appeared logical to attempt to solve it in software.

"Although this is outside my field of responsibility, strictly speaking, I felt I could make a useful contribution since I am the person who understands the EDS best in the XTE-SOC. I developed a tool that provides the user with a set of recommended EDS configurations, ranked according to suitability, on the basis of requirements provided by the user. Those requirements are given in scientific terms: what time resolution does the user want; what spectral resolution; how much telemetry bandwidth is available; what are the characteristics of the source? In addition, it can optimize one or more of these, on the basis of boundary conditions set by the others.

"It is very much like an Artificial Intelligence tool, employing fuzzy logic, that attempts to optimize the science as well as the use of telemetry. Tests were successful, though a little more tweaking of the parameters is required. It has also fulfilled an important function in that it has allayed any fears brought about by the imposing capabilities of the EDS."

The current version of `recommd` is 2.3, which I consider the final one for XTE's AO-1. It is quite stable and provides a rich suite of capabilities. It will provide combinations of Event, Single Bit, and Binned Mode configurations for up to four Event Analyzers (the maximum is controlled by the user), assessing their suitability on the basis of the user-provided constraints outlined above. In addition, it will take care of the background and provide the user with signal-to-noise estimates for six spectral ranges, as well as by Xenon layer. These latter features aid the user in choosing layers and calculating observing time requirements.

`recommd`'s software employs a number of advanced software technologies. It can be used with any C compiler; it certainly works with Sun's `cc` and, more importantly, with the ANSI-C compliant `gcc` compiler from Gnu. For the suitability evaluation, `recommd` has to consider about a quarter of a million different configuration combinations. Yet, a single run takes only about 5 seconds on a Sparc-10 and a little over 6 seconds on a 486-DX/2 running under Linux.

## 2 Community

I continued as a member of the OGIP FITS Working Group and participated in the FITS session at the Baltimore ADASS meeting.

## 3 Research

### 3.1 Period Searching Algorithms

Last quarter I reported on plans to investigate the performance of different period searching algorithms:

"Now that Jim Lochner has implemented a first version of a time series data simulator, as well as a period search program based on Scargle's algorithm, I decided that the time is ripe for a formal research project aimed at investigating the effectiveness of various period searching algorithms. I have recruited the other scientists in the XTE-GOF for this project, and together

we hope to be able to shed some light on this question by running a series of systematic tests on at least three algorithms: Scargle, period folding, and Gregory-Loredo. I intend to report on this at the HEAD meeting in November."

Work on this has now started and we shall add a Fourier algorithm to the list.

## 4 Travel

I attended the fifth annual ADASS (Astronomical Data Analysis and Software System) conference, in Baltimore, September 25-28. I found the meeting less exciting than in some previous years, with many people busy re-inventing the wheel, but two useful things emerged: a thorough discussion of the World Coordinate System proposal in the FITS session, and the announcement by the Aips++ group that they will be using Glish for command and process control, which looks like an extremely useful tool.

## 5 Next Quarter

During the next quarter I will continue the design of the FITS Data Finder which will act as a Data Base Management System for the hierarchy of XFF-generated FITS files. We will follow the general XFF development plan. By the end of the quarter we should be able to generate a fairly complete FITS database.

I will further pursue application of the Gregory-Loredo timing analysis algorithm in the context of the general period search testing project, mentioned above.

We hope to start on a paper on our ROSAT observations of the NGC 1961 group.

## Quarterly Technical Report

Eric M. Schlegel

Activity: 5030-04A-39

This report will cover the period of 1 July to 30 September 1994.

During the above named period, I have been working on a mixture of science and programmatic tasks. These will be outlined below.

### Science

I spent much of the summer working with 3 students, 2 from the University of Maryland and one from Ball State University (Indiana). Their work is described first.

I supervised Todd Hillwig (Ball State) in analyzing the accretion disk images obtained by back-projection of the  $H\beta$  and  $H\gamma$  emission lines. The goal of our work is the radial emission behavior as a function of cataclysmic variable class. We found that nearly all of the dwarf novae and novalikes have radial emissivity curves of very similar shapes. The novalikes, however, show the peak of the curve at lower velocities than the dwarf novae. Analysis of the data obtained will likely constitute Todd's second-year project at BSU.

I supervised Scott Miller (U. of MD) in his examination of the *ROSAT* PSPC data on the galaxy NGC 1313. NGC 1313 is the parent galaxy of the supernova SN1978K (see below). A second epoch of PSPC data were obtained last November. Scott's job is to compare this epoch with the April 1991 data (in which SN1978K was discovered) and to sum the 2 observations. The sum of the data will permit a deeper search for diffuse emission in this galaxy. Diffuse emission is of interest because it likely represents the long-predicted hot phase of the interstellar medium.

Meredith MacKenzie (U. of MD) and I worked on the *BBXRT* data on the galaxy clusters Abell 262 and Abell 496. Both clusters are bright, but neither was observed for a long time with *BBXRT* as a result of the pointing problems during that mission. The data, however, are sufficiently good that the cluster cooling flow in A496 is evident. A paper describing the results of the observations is in preparation.

The prime research I worked on this summer is the X-ray light curve of SN1978K. X-rays arise from SN1978K as a result of a circumstellar interaction between the outgoing shock from the explosion and whatever matter exists in the immediate region around the supernova. I presented a brief paper on SN1978K at the Edinburgh



circumstellar matter conference in August.

The paper describing upper limits on the  $\gamma$ -ray emission from cataclysmic variables (CVs) has been accepted by ApJ and will appear in one of the January 1995 issues.

The *ROSAT* data on the galaxy NGC 6946 has been scheduled for publication in the October 20 issue of ApJ.

The paper describing the X-ray emission of the historical supernovae present in the spiral galaxy NGC 6946 has been accepted by AJ and will appear in the November issue

The paper, submitted to MNRAS, describing the *ROSAT* PSPC observation of the eclipsing cataclysmic variable EP Dra, is still in the referee process.

A paper is nearing completion describing the results of work done during the summer of 1993 with a student from the University of Maryland. We examined the amateurs' databases on the dwarf novae VW Hyi and Z Cha (both southern hemisphere objects). The databases extend over 40 years, representing more than 10,000 visual observations of these two stars. A simulation code is being developed to be used to understand some of the results obtained from the data. The paper is largely written, with the exception of a final section. It will likely be submitted before the end of 1994.

### Programmatic Tasks

During the above period, two key programmatic tasks were worked on: preparation for the XTE NASA Research Announcement and revamping the guest observer proposal preparation tools.

The XTE NRA will describe the satellite and instruments for potential guest observers. The official release date is 30 November 1994. The document must be presented to NASA HQ by 30 September 1994. During the past quarter, I have written all of the text not describing the instruments (that will be supplied by the instrument teams) based on the policy guidelines developed during March-May. I am responsible for editing the complete, final package. That task is on-going.

In addition, based upon past experience with guest observers and their interaction with the proposal preparation tools, a decision was made to re-vamp those tools. The prime tool (known as RPS for Remote Proposal Submission) is a rather complex piece of software that makes it particularly difficult to alter for a new mission. The RPS "revamping committee" (of which I am a part) is charged with coming up with a different approach. I am the lead scientist on the new RPS committee; I have provided advice from a user's point-of-view, as well as served as a source of information from the XTE team. The software is now in a testing phase. I have provided considerable feedback to the programming staff about design changes.

The software is about to be released for Lab-wide testing.

### Travel

I attended the Edinburgh circumstellar matter meeting at the end of August. The meeting gathered about 200 researchers from around the world to discuss circumstellar matter in all contexts. Most of the meeting was devoted to star formation studies. Very little material was presented on the X-ray emission associated with circumstellar matter. I presented a paper on the X-ray emission from SN1978K.

### Tasks Planned

The following tasks are planned for the fourth quarter of 1994.

For science, I intend to work to complete the supernova X-ray review paper I am writing, likely destined for a review journal such as *Reports on Progress in Physics*. In addition, the following papers should be completed during this time: the *ROSAT* PSPC data on SN1978K light curve (the first X-ray light curve), the VW Hyi/Z Cha data, and the identification of serendipitous sources in the fields of EP Dra and NGC 6946.

The programmatic tasks on the agenda are the completion of the XTE GO proposal preparation tools and the completion of the XTE NRA. The NRA must be distributed to potential proposers by 30 November.

During the coming quarter, I will likely attend three meetings: first, the data analysis meeting in Baltimore (end of September), second, the Dark Matter meeting at the University of Maryland, and third, the High Energy Astrophysics Division meeting in San Francisco in November.

USRA REPORT 7/1/94 - 9/30/94

Dr A.B.Giles

Employee Task No: 93-05-00

During the above period Dr Giles continued as the Software Manager for the PCA experiment software development and deliveries to the XTE Science Operations Center. He also continued to support the Goddard team developing the PCA detectors for the XTE satellite.

**Meetings:-**

Dr Giles regularly attended the following list of meetings at GSFC in connection with the PCA experiment:

PCA software deliveries to SOC (Chair)	~every 3 weeks
PCA representative on the SOC meetings	alt. Mondays
PCA full team group meeting	every Friday
PCA representative on GOF meetings	occasional

Other specific meetings or activities were:

2nd Hard Line Test	10-12 Jul	GSFC
Instrument Teams (IT) meeting	8 Aug	STX
8th Instrument Operations Working Group	9 Aug	GSFC
SOF Review of Health & Safety	10 Aug	STX
SOF Review of Data Management	19 Aug	STX
SOF Review of Command Generation	26 Aug	STX
Project review of plans	26 Aug	GSFC
SOF Review of Mission monitoring	30 Aug	STX
SOF Review of Science monitoring	31 Aug	STX
XTE software team PCA packet review	6 Sep	GSFC
1st End to End Test	14-15 Sep	GSFC
9th Instrument Operations Working Group	21 Sep	GSFC
XTE Science Working Group (SWG)	22-23 Sep	GSFC

**Conferences:-**

Dr Giles presented an invited paper entitled "Prospects for Coordinated Observations with XTE" at the 28th Annual General Meeting of the Australian Astronomical Society in Canberra, Australia, 11-15 July.

**Travel:-**

Visit to Australia. Away 7-17 July.

**Activities:-**

As PCA Software Manager Dr Giles major activities for the period were the preparations and deliveries for the XTE SOC Builds 3.1 & 3.2. Almost all the required items were delivered on time.

Excellent progress continues to be made on the four main subsystems PCA are developing:

- a) Command Generation - this was used to generate commands for:  
     The 2nd Hardline Data Flow on 10-12 July  
     The 1st End to End Test on 14-15 Sept  
     Only minor improvements are now required.
- b) Mission monitoring - this subsystem is closely linked to Command Generation and has undergone extensive redesign by the SOF during this period resulting in more work for PCA. This subsystem was part tested during the 1st End to End Test.
- c) Health & Safety (housekeeping monitoring) - this subsystem continues to make rapid progress. The implementation of all the required features will now run into 1995.
- d) Science Monitoring - has also made rapid progress since its re-design. STD modes 1 & 2 were essentially completed during the period. The implementation of new tools, termed "Spectral Science Modes", based on derivatives of STD Mode 2 is now underway.

Dr Giles and the PCA programming team have continued to play an important role in assisting the SOC by remaining at the "leading edge" of the IT interfaces to the SOF and hence acting in many ways as "trail blazers".

As Software Manager Dr Giles continues to coordinate the work of the following programmers:

Hwa-ja Rhee	Hughes STX	PCA Science Monitoring - SOF
Vikram Savkoor	Hughes STX	PCA Commanding - SOF
Ramesh Ponneganti	Hughes STX	PCA Housekeeping - SOF
Mike Stark	UMD	PCA Background modelling - GOF
Aileen Barry	Hughes STX	now on extended leave to the Explorer project

Dr Tod Strohmayr arrived at GSFC on 5th July to join the PCA science team. The following PCA scientists calibration work & deliveries (FTOOLS & FITS files) to the GOF are being coordinated by Dr Giles.

Tod Strohmayr	Field of view & boresite
Will Zhang	Dead time
Keith Jahoda	Response matrices
Mike Stark	Background model

#### **Documents:-**

The following documents have been updated or enhanced:

- a) PCA Housekeeping Manual
- b) PCA Commands Manual
- c) PCA Science Monitoring Manual
- d) PCA Calibration document

e) PCA Telemetry Simulator manual

Two chapters for the SOC NRA, now due out in December 1994, were coordinated by and written in part by Dr Giles:

- a) The final version of the PCA Instrument Description chapter (22 pages) is just being delivered. Dr Giles wrote most of this chapter.
- b) The PCA Feasibility chapter required many meetings between the GOF & PCA but is almost complete. Dr Giles coordinated much of this activity and wrote parts of the chapter.

The first draft of the "Instrument Operation Users Guide" (56 pages) was prepared by Dr Giles and delivered to the IOWG on 4/29/94. This is now being reviewed and new sections added. In particular Dr Giles added a new section on PCA safing procedures before the 21st Sept IOWG meeting.

**Publication Activities:-**

The paper Dr Giles gave in Australia has been formally written up and submitted for publication in Proceedings of the Astronomical Society of Australia. This is a refereed journal.

Dr Giles is preparing a poster paper for the session on XTE at the HEAD meeting at Napa near San Francisco in early November.

**Next Quarter:-**

Dr Giles principal activity for the next quarter will be to complete the SOC-PCA delivery schedule for Build 3.3 and proceed onto Build 4. The next quarter has many delivery deadlines both for documents and for code.

The release of the NRA (including the PCA sections) will be a major milestone.

Task Number: 5030-05A-39

Quarterly Report: 1 July 1994 – 30 September 1994  
*Weiping Zhang*

## 1 Introduction

In this quarter we delivered all 5 proportional counters to the XTE spacecraft team for integration. It represents a significant milestone in terms of both the progress of the XTE/PCA project and in terms of my own time. During the previous quarters when we were still working in order to deliver detectors on time, I had almost no time at all for doing my own research. This quarter marks the first time since I joined USRA almost three years ago that I spent a significant fraction ( $\sim 30\%$ ) of my time doing my independent research. I expect this will continue in the next quarter.

## 2 The XTE Integration Test

In the last week of July, I participated in the 2nd XTE integration and end-to-end testing. I was responsible for analyzing the data collected during the test for any anomalies and for characterization. In particular, I was responsible for checking the accuracy of the spacecraft clock and for checking the software that manipulates the clock data. Overall we had a very successful test. We obtained a large amount of useful data for calibration and characterization. Especially, I uncovered and understood a special feature in the event time interval distributions which showed up when input event rate became extremely high. It is crucial to the future timing analysis for us to have understood such a feature. This feature also helped us to further classify the kind of deadtime that the XTE/PCA detectors have.

## 3 Feasibility Preparation

Another significant activity that I have spent a large portion of my time on was to prepare the necessary documents for release to the general astrophysics community. As is known, XTE is a mission dedicated to all the x-ray astronomers. They will write proposals to apply for observation time on XTE. Thus it becomes crucially important for those of us responsible for constructing and calibrating XTE to document features and capabilities of XTE. Specifically I wrote a section on the detection of Quasi-periodic oscillations for the XTE technical appendix on the sensitivities of XTE instrument to various astrophysical x-ray sources.

In addition, I also developed software for distribution to calculate the dead-time for each observation.

## 4 Calibration Facility

I initiated a project for Dr. Dick Deslattes of the National Institute of Science and Technology to build a monochromator to be installed in the Goddard x-ray beam facility to further characterize the energy response of XTE/PCA detectors. I am still engaged in active negotiation with him with regarding to the specifications and costs and the time of delivery.

## 5 IAU Symposium 165

I attended the International Astronomical Union's 165th Symposium in the Hague, the Netherlands. It was on compact stars in binaries. I presented a poster paper that detailed the XTE/PCA capabilities for investigating timing behaviors and neutron stars and black hole in very short time scales. I also communicated with some of the experts in doing x-ray timing analyses on how to best characterize and calibrate the XTE/PCA proportional counters. It was a very fruitful trip.

## 6 Research Activity

Together with my collaborators K. Jahoda, Jean Swank, E. Morgan, and A. B. Giles, I have written a paper on correcting for the deadtime effects in x-ray timing analysis. It presents for the first time a set of rigorous analytical formulae that anyone can use for calculating the effects of deadtime. It will be submitted soon to the Astrophysical Journal for publication.

## 7 XTE Proposal for Senior Review

During this quarter I also helped Dr. Jean Swank in preparing the proposal that NASA required for justifying the sciences that XTE can do. I was responsible for doing simulation on observing matter blobs circulating stellar black holes. My simulation demonstrated that XTE/PCA has unique sensitivity that no previous missions had. It highlighted the timing capability of the XTE/PCA timing characteristics.

## 8 Next Quarter

The following things are on my list that have to be done in the next three months:

1. Monitor the performance of all the XTE/PCA detectors.
2. Prepare XTE observing proposals.
3. Investigate the noise properties of black hole candidates.
4. Set up calibration facility to characterize XTE/PCA detectors better.



**Quarterly Technical Report**  
(1 July - 30 September 1994)

Name: Wan Chen  
Position: Research Associate  
Task Number: 5000-643  
Date: 3 October 1994

Trip: 13-20 August, 1994, The Hague, The Netherlands, IAU 22nd General Assembly and IAU Symposium 165 "Compact Stars in Binaries", a poster paper presented: "Systematic and Statistical Study of X-ray Nova Light Curves", with Chris Shrader (GSFC) and Mario Livio (STScI)

Work accomplished:

- [1] ASCA Observations of Quiescent X-ray Novae, a research proposal submitted to ASCA AO-3, 30 August 1994, Chris Shrader and Wan Chen.

Work in progress and planned for the next quarter:

1. Understanding the COMPTEL  $^{26}\text{Al}$  1.8 MeV Map Features, Wan Chen, Neil Gehrels, and Roland Diehl, submitted to ApJ Letters, 15 June 1994, a revised manuscript after the referee report will be resubmitted to ApJ Letter in early October.
2. Compilation and classification of all known X-ray nova light curves and a complete review of the current theory and observations of X-ray nova, an ApJ paper in preparation with Chris Shrader, Jim Lochner, and Mario Livio.
3. A New Model of Nonthermal Synchrotron Radio Emission from Massive Stellar Winds, an ApJ paper in preparation with Richard L. White.
4. Understanding the Black Hole X-ray Novae Using Disk Instability Models, an ApJ paper in preparation with John Cannizzo and Mario Livio.
5. Search for 1.8 MeV Emission of  $^{26}\text{Al}$  from Nearby Supernova Remnants, an ApJ paper in preparation with Neil Gehrels, Roland Diehl, and Uwe Oberlack.

From: Dr. Eric R. Christian  
NASA/GSFC Mail Code 661

October 5, 1994

**Quarterly Technical Report**  
3rd Quarter, 1994

**ALICE (A Large Isotopic Composition Experiment):** ALICE is a balloon-borne experiment designed to measure the elemental and isotopic composition of galactic cosmic rays in the charge range Silicon to Nickel between 400 and 800 MeV/nucleon. It is a collaboration with the U. of Siegen in Germany. A paper on the isotopic composition of Silicon and Iron (abstract enclosed) has been submitted to Astrophysical Journal and we are waiting for referee comments. Although I am not first author on this paper, I have been very active in the data analysis, writing and editing of this paper (and am the first US author). Getting this paper published will probably be the last of my ALICE work.

**Voyager Cosmic Ray System:** I continue to work with Drs. Ed Stone and Alan Cummings of Caltech on a paper for the Astrophysical Journal. We have decided to include more recent data which is now being analyzed. At the end of October, I will be going out to Caltech, and one of the things that I will work on is this paper.

**IMAX (Isotope Matter-Antimatter eXperiment):** IMAX is a balloon experiment which we are working on with Caltech, U. of Siegen, and NMSU to measure the fluxes of anti-protons, and Hydrogen and Helium isotopes over a wide energy range. During this quarter, I have continued to work on the analysis of the data from our successful 1992 flight. I am responsible for the energy loss measurement in four scintillation counters, including mapping and other calibrations and corrections. This work will continue over this entire year. Preliminary science results were presented at the European Cosmic Ray Conference. We hope to start writing the refereed papers this next quarter.

**TIGER (Trans-Iron Galactic Element Recorder):** TIGER is a balloon experiment designed to look at ultra-heavy galactic cosmic rays. It is an collaboration with Washington U. (St. Louis) and U. of Minnesota. Our counters are ready but due to delays at Wash. U., the flight has been delayed until summer 1995. This project will remain at a low but constant level of effort until full integration next spring.

ISOMAX: This is another magnetic spectrometer balloon experiment in collaboration with Caltech and U. of Siegen. It is specifically designed to look at the isotopic composition of Beryllium, because  $^{10}\text{Be}$  is a very important clock that can measure the lifetime of all cosmic rays. Because  $^{10}\text{Be}$  is a rare isotope, the experiment is being designed for long duration flights from Antarctica or Greenland, although the first flight in 1995 is planned for Canada. I am responsible for the onboard command and data handling (C&DH) system and the ground support equipment (GSE). The C&DH system prototype has finished testing and flight boards are being manufactured. Software work on both the C&DH and GSE are continuing.

ACE (Advanced Composition Explorer): ACE is an Explorer that is planned for launch in 1997 to study the solar wind, and heliospheric and low energy galactic cosmic rays. I am an assistant to the Project Scientist (Jon Ormes). This requires spending considerable amount of time in meetings and facilitating communication between the project management here at Goddard, the spacecraft contractor (the Applied Physics Laboratory), and the experiment teams. I am also on the science team for two of the instruments onboard. During this quarter, the amount of time I've spent working on ACE has increased, and this will continue into the next quarter. I am a member the ACE Mission Operations Working Group, the Initial Operations Working Group, and the Spacecraft Operations Working Group, all of which meet monthly. I also attend weekly project meetings and the monthly APL status meeting. During the last quarter, I attended several instrument Preliminary and Critical Design Reviews. I also write a monthly "What's New on ACE" newsletter for the science team.

I have also been working with Drs. Dan Baker (NASA/GSFC) and John Cooper (NSSDC) on some theoretical work on solar modulation. We are attempting to gain insight into modulation processes by treating the heliosphere in the same way planetary magnetospheres are treated (which are their specialty).

On top of all this, I am the system manager for the new UNIX computer system the group has bought for use in IMAX and ISOMAX data analysis. As part of this, I am giving a series of lectures to the group on the new software and environment.

TO: David Holdridge/610.3, USRA  
FROM: Scott Barthelmy/661  
RE: 3rd Quarter 1994 Report

:28 Sep 1994

This report describes 4 areas of activities: the Gamma Ray Imaging Spectrometer (GRIS), the BACODINE project, the Gamma ray To Optical Transient Experiment (GTOTE), and several miscellaneous activities. My effort was split approximately 20/60/20/0. The activities described below are mine either directly or through the supervision of others. For the GRIS project there is one other scientist whose efforts are in other areas and are not described here. There are no other scientists contributing on the BACODINE project.

#### **GRIS project activities:**

I am starting to get back into the swing of things with the GRIS program for the upcoming balloon flight expedition to Australia this coming Spring. I started making the mods to the GSE program that will handle the new technology piggyback instrument (PORTIA) and the new wide-field collimator and blocking crystal.

#### **BACODINE project activities:**

The BACODINE project continues grow. Two more operations were added: another radio telescope and a group of serious amateurs. This later group is composed of 7 people around the US who are notified via the newly added "beeper" method.

The U.MD grad student, James Kuyper, is no longer with the project. He is now pursuing a full-time effort in his studies of Grand Unified Field Theory. He finished his work at the end of this summer term on porting the non-cos(theta) & scattering correction programs from Huntsville to the BACODINE machine. They are running but their locations have not yet been enabled for public distribution.

The "renewal" proposal for BACODINE to the GRO Guest Investigator Phase 4 cycle was accepted with a funding level of \$67K plus another \$30K from Huntsville.

I received a GSFC "Special Act Group Award" from Dr. Kleinberg this month. Of the 66 candidates groups/projects nominated only 27 were chosen for awards. The BACODINE project was honored along with the Hubble Repair Team, the NOAA-7 & GOES-7 Tiger Teams, and the GRO Reboost Team.

#### **GTOTE project activities:**

This project has maintained a high level of effort. An electronics engineer and two E-techs are assigned to the project. The CCD camera (the last subsystem to be obtained) was delivered in Aug. John DiFelici (hired as a consultant through USRA) continues the software development for the system. System integration at the GSFC OTS should happen in the next month.

#### **GRB Follow-up Proposals:**

Nothing this quarter.

#### **Other Proposals:**

I am Co-I on 2 GRO GI Ph4 proposals: titled 1) "Improving BATSE's Threshold with Archival Data" (B. Schaefer is PI), 2) "Deep Optical Search Project" (B. Schaefer is PI). Both were accepted, although (1) was without money.

**Quarterly Technical Report**  
**David Palmer**  
**July – September, 1994**

During the past three months I have been involved in five projects, namely:

- 1) Analysis of Gamma-Ray Burst (GRB) data from the BATSE SD instrument on Compton Gamma-Ray Observatory (GRO);
- 2) Search for radio counterparts of GRBs;
- 3) Preparation of the Transient Gamma-Ray Spectrometer (TGRS) for launch on the WIND spacecraft, scheduled for November 1994;
- 4) New instrument development;
- 5) Miscellaneous.

**BATSE Spectroscopy Detector Analysis**

I am continuing to search for spectral lines in GRBs. I still have not detected any. The Astrophysical Journal Letter which summarizes the search (as of March) is in the October 1, 1994 issue.

**Search For Radio Counterparts of GRBs**

In early July I traveled to Charlottesville, VA to analyze my Very Large Array (VLA) radio observations of GRB locations.

A paper I collaborated on with the Cambridge Low Frequency Synthesis Telescope (CLFST) group has appeared in Monthly Notices of the Royal Astronomical Society. We are currently working on slaving the CLFST to signals from BACODINE (see Scott Barthelmy's reports) to get simultaneous radio and gamma-ray observations.

**TGRS Preparations**

TGRS is still on schedule for a November 1 launch. I have participated in the testing and checkout of our instrument. During the launch, I will be responsible for final checkout to give a GO/NO-GO decision.

I have been verifying and debugging some housekeeping software that I specified for TGRS.

**New Instrument Development**

I am involved in preliminary design of a new GRB instrument which will use a coded aperture. I have coded aperture experience from my Ph.D. project working on the Gamma-Ray Imaging Payload (GRIP) at California Institute of Technology.

## Miscellaneous

My miscellaneous activities include the Gamma-Ray Burst workshop at the Aspen Center for Physics. This workshop was very productive, although nothing was settled. On return C. Graziani, R. Nemiroff and I gave a summary talk to the LHEA group on ten major controversies which remain unresolved.

I have also been assisting a summer intern, Joseph Dodoo (who teaches at a University of Maryland campus out on the Eastern Shore). His project is to simulate the TGRS instrument's response to gamma radiation, using a package called GEANT. My assistance has generally been to help him develop his programming style and debugging techniques. He is continuing to work part time on this project.

A handwritten signature in black ink, appearing to read 'D. Palmer', with a long horizontal flourish extending to the right.

David Palmer

# **USRA Technical Report (3rd Quarter, 1994)**

Helmut Seifert (Task Number: 93-10-00; Activity: 5030-10A-39)

## **Task Description:**

I have been leading the Transient Gamma-Ray Spectrometer (TGRS) software development, and am responsible for all the software requirements, specifications and documentation. I am also responsible for the design and testing of the algorithms used by the software. Similar work is done by me also for the KONUS instrument. I have been taking a leading part in the laboratory testing of the TGRS analog/digital flight electronics and software, and have been responsible for formulating and conducting all the instrument tests and calibrations during the integration and calibration phase of TGRS, as well as for the design of the procedures used during the actual flight mission.

## **Activities:**

During the last quarter I was involved in a series of spacecraft test, the final tests of TGRS and the WIND spacecraft before and after delivery of the spacecraft to Cape Canaveral in September 1994:

I supported a Mission Profile Test (MPT) on 21–22 July 1994, and two Limited Performance Tests (LPT) on 23–24 July and 28–29 July from the POCC in Bldg. 14, NASA/GSFC.

I also supported a Mission Profile Test (MPT) on 1–2 August 1994, a Comprehensive Performance Tests (CPT) on 6–9 August 1994, and the Added Confidence Test (ACT) from 17–24 August 1994, again from the POCC in Bldg. 14, NASA/GSFC. In this test, among other things, we verified to functionality of two flight software patches which were described in the last technical report.

The spacecraft was delivered to Kennedy Space Center, Cape Canaveral, Florida, after the ACT on 7 September 1994.

The last Mission Profile Test (MPT) was on 13–14 September 1994, and a Limited Performance Tests (LPT) on 22–23 September 1994. Finally, a Launch Countdown Rehearsal took place on 26 September 1994.

For these tests and for preparation of the actual Flight Operations I worked with the Flight Operations Team (FOT) on the TGRS procedures, telemetry, command, and constraint database. All issues relevant for the mission and early flight operations are resolved now.

Apart from the above activities work on the development of the TGRS data analysis software has continued. This involves regular meetings and discussions with the programmers. Further progress has been made in the last quarter and we have now working (for some programs initial) versions of the most crucial data analysis programs.

Monte-Carlo simulations of the TGRS instrument are continuing using the GEANT software from CERN. This work will be crucial for calibration and the interpretation of our flight data.

I will continue with the same activities during the 4th quarter, and also will support upcoming tests and the launch of TGRS and the WIND spacecraft at Kennedy Space Center in Florida from 24 October 1994 – 1 November 1994.



## UNIVERSITIES SPACE RESEARCH ASSOCIATION

### QUARTERLY TECHNICAL REPORT- Third quarter of 1994 - 10/6/94

Employee Name: John W. Mitchell    Task Number: 5030-11A-39

During the past quarter my primary activities were development work for the ISOMAX balloon program, analysis of the 1992 IMAX flight, analysis of data from accelerator experiments, and development work on new flight and ground based experiments. Also, during the past quarter, I worked on preparing three new papers for publication.

ISOMAX - Isotope Magnet Experiment: I am Instrument Manager for ISOMAX, which is being developed by GSFC, Caltech, and the University of Siegen (Germany). In this capacity, during the last quarter, I worked on a variety of experiment issues including instrument configuration, electronics, power, and structure.

The past quarter has been a period of intense development effort on the ISOMAX mechanical structure and electrical/electronic systems. I have directed much of this effort, working closely with the engineers and technicians both at GSFC and Caltech. In addition, I have begun the process of obtaining the many supplies and ancillary equipment required to complete the instrument and to stage the balloon campaign.

The ISOMAX instrument design has continued to evolve during the past quarter as detector designs and the instrument structure have become better defined. I have been coordinating these developments and have maintained a CAD model of the instrument configuration as well as simulations of the instrument performance.

The instrument is based on a new large superconducting magnet, for which I am directly responsible. The contract to build the magnet was awarded to Oxford Instruments. During the past quarter, I have been working with Oxford on the magnet design to insure that it will meet our dimensional and performance needs.

I am also responsible for the time-of-flight system and the experiment electronics, including development of new low-power flight systems. During the past quarter I worked on the continuing development of hardware for the low power electronics, in particular a charge-sensitive amplifier system for use with the Cherenkov detectors. I have also worked with engineers at LHEA and Caltech developing the control and housekeeping interfaces for the experiment. I have defined the power switching system and have continued to develop the experiment trigger.

ISOMAX activities will occupy most of my time during the next quarter.

IMAX (Isotope Matter-Antimatter eXperiment) - This instrument was built and flown by GSFC, Caltech, NMSU, and the University of Siegen (Germany).

I am working directly with two graduate students, Wolfgang Menn and Olaf Reimer, at the University of Siegen, Germany, analyzing the IMAX TOF and aerogel Cherenkov detectors. This work will continue during the next quarter. In addition, the collaboration has moved from detector analysis to physics analysis. I am heavily involved in this process.

The results to date are very exciting, with indications that we have detected a number of cosmic ray antiprotons. In addition, the mass resolution is excellent, indicating that the light isotope results will be quite good.

During the next quarter, I expect to work on preparing one or more IMAX papers for publication.

IMAX results were presented at the European Cosmic Ray Conference in August, 1994.

MASS/WiZard: The WiZard-Related Balloon Program is conducted by an international collaboration with researchers from the U.S. (NMSU and GSFC), Italy, Germany, Sweden, India, and Russia. In its 1994 configuration, known as CAPRICE, the detector systems include a new ring-imaging Cherenkov detector. My responsibilities in this experiment are the time-of-flight system and the trigger electronics.

During the past quarter, I traveled to Lynn Lake, Manitoba, Canada to participate in final preflight preparations for the CAPRICE (WiZard) flight. During this trip, I checked out both the flight electronics and the time-of-flight system. CAPRICE was flown successfully in August, 1994.

SMILI (Superconducting Magnet Instrument for Light Isotopes): The SMILI instrument flew twice: in August, 1989, and in August, 1991. During the past quarter analysis continued on data from both flights.

E878 (ANTI): This is a program of experiments at the Brookhaven National Laboratory Alternating Gradient Synchrotron (AGS) to obtain the heavy-ion-collision production spectrum of pions, kaons and antiprotons in the energy range from 1.5 GeV to 24 GeV. E878 will also conduct a high statistics search for the production of antideuterons or exotic particles in this energy range.

During the past quarter, I participated in analysis of E878 data.

An initial E878 paper was accepted for publication during the past quarter. During the next quarter, three E878 papers will be presented at the Fall Meeting of the Division of Nuclear Physics of the American Physical Society.

Experiments E683H and E849H: The results from E849H are now being prepared for publication. The publication has reached a final draft stage and will be submitted to the Physical Review during the next quarter. Following this publication, the analysis techniques developed for E849H will be applied to the E683H analysis.

Experiment E938H (Transport Collaboration): During the past quarter, I participated in the analysis effort and in other collaboration activities. In particular, I directed work on improving the calculations of the particle flight times.

During the past quarter, I worked on preparing a new Transport proposal, which was submitted to NASA in August, 1994. This proposal includes both an extension of the current Transport effort and a new series of experimental runs. I was most involved in developing the plans for the new runs. I am Institutional Principal Investigator on this proposal.

Three E938H papers are in final preparation. It is expected that at least two of these papers will be submitted during the next quarter.

TIGER - Trans-Iron Galactic Element Recorder: This experiment is conducted by a collaboration between Washington University, the University of Minnesota and GSFC. During the past quarter, I worked on TOF system development and testing as well as in

general experiment planning. I also worked on the experiment electronics. It is planned that the first flight of the instrument will take place in summer, 1995.

BESS - Balloon-Borne Experiment with a Superconducting Solenoidal Magnet Spectrometer: The BESS experiment is a search for low energy antiprotons and antihelium at a sensitivity much greater than current upper limits. BESS was flown for the second time in July, 1994. In preparation for this flight, I worked extensively with the BESS group and with engineers in the US developing a thermal model and thermal control plan for the BESS instrument.

A paper on BESS was presented at the COSPAR meeting in August, 1994.

E896 (H0): This is a new experiment to search for the H0 dibaryon. The H0 is a six quark MIT bag (uuddss) that is predicted to be produced in great numbers in heavy-ion central collisions. However, it has a short lifetime and has not been detected as yet. The E896 experiment will conduct the most sensitive search to date for this particle. The experiment was accepted by the Program Advisory Committee (PAC) of the Brookhaven National Laboratory Alternating Gradient Synchrotron (AGS) in 3/94. This is one of the first completely new experiments to be accepted by the AGS in some time. I am Institutional Principal Investigator on this program

I have overall responsibility for the experiment electronics, including the fast event trigger, and for the high-rate beam detector system. This system will include a detector which will determine, in real time, the centrality of a particular nuclear collision. This is, in effect, a measure of the degree to which the colliding nuclei struck one another head-on. This determination must be made in about 100 ns.

During the past quarter, I worked on the detector designs and participated in experiment planning activities. I have made preliminary arrangements for the actual fabrication of the beam and centrality detectors to be carried out at Johns Hopkins University.

I will also participate in the development of a second level (software or hardware) trigger and will have a part in development of the critical Distributed Drift Chamber (DDC).

During the past quarter, I participated in a second technical review meeting for E896 at Brookhaven National Laboratory. Many questions regarding the experiment were settled at this meeting and it is expected that the experiment will be given full approval to begin hardware construction during the next quarter. I will be attending a final technical review at BNL on 10/18/94.

New Satellite Experiments: During the past quarter I led the conceptual development of two new experiments to be proposed in response to the USRA satellite AO. These experiments were closely tied to university collaborations involving University of California, Berkeley, The University of Minnesota, Louisiana State University and Louisiana Institute of Technology. In the end, it was decided that neither experiment was sufficiently mature to propose for the STEDI program. However, development of these experiments will continue and it is expected that both will be proposed for future launch opportunities. This was a particularly interesting investigation for me since one of my major responsibilities was to define the spacecraft. I learned a number of things during this work which I expect to make considerable use of in the future.

In addition, I worked on the development of three possible satellite experiments to be performed by international collaborations.

Cosmic Ray Propagation Theory: During the past quarter I worked on a proposal "Investigation of Cosmic Ray Propagation in the Galactic Disk and Halo", which was submitted to NASA in 8/94. Participating institutions: NASA/GSFC, Universities Space Research Association/GSFC, A.F. Ioffe Institute of Physics and Technology (Russia), Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation (Russia). This is a new program directed at developing a modern, comprehensive, numerical model of cosmic ray propagation. This model will be able to take into account such effects as distributed cosmic ray sources, non-uniform matter density, and a variety of acceleration sites and mechanisms. The resulting code will be used to investigate the effect of such features as a galactic halo, galactic wind, and the presence of a local bubble. I am a coinvestigator on this project.

Other Research Activities: During the past quarter I was accepted a position as Visiting Research Scientist at John's Hopkins University. This position was offered in recognition of my work on the E896 and E878 experiments. I will be getting my funding for E896 from DOE and expect to use JHU as a base for this work.

During the past quarter I was invited to join the STAR (Solenoidal Tracker at RHIC) collaboration as part of the JHU group. RHIC (the Relativistic Heavy Ion Collider) is under construction at BNL with a planned turn-on in 1999. STAR is one of two large intersection point experiments to be installed at RHIC. Initially I will be working with the trigger group and will probably be involved with the time-of-flight and the electromagnetic calorimeter.

During the past quarter I participated in the development of a renewal proposal "Development of Solid State Detectors for Charged Particle Measurements in Space" submitted to NASA in August, 1994. This work involves development and testing of the "next-generation" of solid state position sensing detectors and associated readout electronics. This is an entirely GSFC effort with Dr. Tycho T. von Rosenvinge as P.I.. I am a coinvestigator on this project, along with Dr. Louis M. Barbier, Maureen P. Madden, and Dr. Robert E. Streitmatter.

USRA Activities: During the past quarter, I continued as the Code 661 Group Leader. In addition, I wrote two sections for the USRA proposal which was submitted to NRL.

To: USRA

From: Yang Soong, LHEA Code 666, Bldg. 2, Rm 271, X66318

Date: September 30, 1994

Subject: Technical Report for 7/1-9/30, 1994

We have carried out research which was part of the center DDF proposal. The improvements of the image of the thin foil X-ray mirror with the newly established replication process has been verified. A step forward in implementing the technique to the next generation X-ray telescope is well underway. A summer student, Andrew Gray, was selected through the DDF to participate in the activities in this research and development program. Another proposal for lab development in the next three years to the NASA/HQ was also funded with the level at \$75k for mirror research. We also will be thinking and planning for mirror development beyond year 2000 when a cluster of X-ray astrophysics missions would be carried out at the end of this century.

The Astro-E, a US-Japan collaboration which will be a successor of the current ASCA satellite, is in negotiation. We, the Goddard group, will be providing X-ray mirrors, a state-of-the-art high spectral resolution focal point detector, and the data acquisition and analysis system, if we come to an agreement. The need for manpower is urgent. There was a hiring announcement in the April 9th AAS job register posted by USRA, and an internal review of the applications was conducted, by which a committee was chaired by Dr. Will Zhang of USRA. Four applicants were selected to be on the short list, and subsequent interviews were carried out. USRA is in the process of making the final decision.

ASCA data analysis is underway. We are sharing the PV phase data among the PI groups. I am working on the Galactic binary X-ray emitters, such as Her X-1, Vela X-1, 4U0614+091, etc. The spectral data is superior to that of the previous missions due to the excellent energy resolution of the CCD detector. The spatial resolution matched our expectation with the ground testing results. Papers have been presented in various meetings and published or to be published in professional journals.

These activities have been supported by the task # 5030-14A-39.

QUARTERLY REPORT TO USRA FOR THE PERIOD  
1st July 1994 – 30th September 1994

Tahir Yaqoob

TASK No. 93-15-00; EMPLOYEE ID: 05-05 96800

Following is an outline of accomplishments this period.

**Papers accepted for publication**

The following papers were accepted for publication in this period.

- (i) X-ray Spectrum and Variability of the Quasar PG1211+143 (Yaqoob *et al.*).
- (ii) Rapid X-ray Spectral Variability in NGC 3227 (Ptak *et al.*).
- (iii) An *ASCA* Observation of the Seyfert 2 Galaxy MKN 3 (Iwasawa *et al.*).
- (iv) New X-ray Spectral Observations of NGC 4151 with *ASCA* (Weaver *et al.*).

**Proposals Submitted**

In this period a major effort was made to submit a significant number of *ASCA* proposals for the AO-3 phase which lasts for 1 year. The titles and PI names of the proposals submitted are listed below.

- (i) *The Unsolved Mystery of the Quasar E1821+643*. PI: T. Yaqoob.
- (ii) *The AGN Jungle: Missing Pieces of the Jigsaw*. PI: T. Yaqoob.
- (iii) *Probing the X-ray Emission Mechanism and Nuclear Structure in the Quasar PG1211*. PI: T. Yaqoob.
- (iv) *Long Term Monitoring of NGC 4151 with ASCA and OSSE*. PI: P. Serlemitsos.
- (v) *X-ray Spectral Diagnostics of the Low Luminosity AGN NGC 3147*. PI: P. Serlemitsos.
- (vi) *Rapid X-ray Spectral Variability in NGC 3227*. PI: P. Serlemitsos.
- (vii) *Detailed X-ray Study and Monitoring of Low Luminosity AGN*. PI: H. Kunieda (Nagoya University, Japan).
- (viii) *Probing the Veiled Cores of Narrow Emission Line Galaxies*. PI: K. Weaver (Penn State University).

(ix) *Unmasking a Hidden Seyfert 1 Nucleus with ASCA*. PI: K. Weaver (Penn State University).

(xi) *MCG+8-11-11: X-ray Spectral Features in Seyfert 1s*. PI: K. Leighly (GSFC).

(xii) *X-ray Reprocessing in MKN 509*. PI: K. Leighly (GSFC).

(xiii) *AGN unification models: simultaneous ASCA and GRO observations of Mkn 3*. PI: K. Iwasawa.

A proposal for data from the OSSE instrument aboard the GRO mission for the above simultaneous observation proposal was also co-authored with Dr. K. Nandra from Cambridge University, UK. The proposal was entitled *AGN unification models: simultaneous ASCA and GRO observations of Mkn 3*.

### Analysis of ASCA Data

In this period, data analysis was begun on a fairly major project, in collaboration with Dr P. Serlemitsos and A. Ptak. The project involves the analysis of data on four objects we obtained from the AO-1 period of *ASCA* but the project will also utilize data from the *ASCA* Performance Verification phase for similar classes of object. The objects are normally classed as 'normal spiral galaxies'. These galaxies have not been studied in the X-ray band above a few keV due to the faintness of the sources and lack of sensitivity of previous instruments. However, the high sensitivity of *ASCA* with its improved energy resolution has allowed us to obtain the first broadband X-ray spectra of these galaxies (covering both the soft and hard X-ray band). The preliminary results show that the data for the objects we have show a variety of different types of X-ray spectra, some of the characteristics of which we have been able to identify in other well-studied *active galaxies* (which are much brighter). Our aims are to constrain the origin of the X-ray emission (in some cases there is good evidence for *two* sources of X-ray emission) and understand to what extent the X-ray emission in these so-called *normal* galaxies can be identified with a hidden active nucleus and/or bursts of star formation. This will provide clues to the connection between normal and active galaxies. We will also correlate the soft and hard X-ray properties with published data from other wavebands to provide further clues. Also, the fact that normal galaxies are significant hard X-ray emitters, the implications for the diffuse Cosmic X-ray Background radiation from such sources will also be investigated.

### WORK PLANNED FOR NEXT QUARTER

In the next quarter, further work will be carried out on the *ASCA* data project outlined above. Work will also continue on other *ASCA* analysis from data from the Performance Verification phase and data obtained from subsequent AO periods, as time permits. A poster paper will be presented at the symposium of the High Energy Astrophysics Division (HEAD) of the AAS to be held in Napa Valley, California, in November 1994.

*Caroline K. Stahle*

Time period:

August 11, 1994 (hire date) through September 30, 1994

My work for the last quarter was divided among the categories of ASCA proposal writing and data analysis, support of the XRS breadboard test, XRS detector development and testing, and coordinating the X-ray contribution to the LHEA AAS observatory report, as detailed below.

### ASCA

Proposals for observing time on the Japanese and U. S. Advanced Satellite for Cosmology and Astrophysics were due August 30. As principal investigator, I prepared and submitted a proposal to investigate possible Comptonized line emission from the massive X-ray binary pulsar SMC X-1, and as a co-investigator I contributed to a joint ASCA-HST proposal to study LMC X-4. I have continued to try to understand some ASCA performance verification data from SMC X-1, which provided the motivation for the primary proposal.

### XRS Breadboard Test

A major test of the X-Ray Spectrometer front end assembly and analog signal electronics was conducted. This was to enable the acquisition of data from 16 X-ray calorimeters in one cool-down of an adiabatic demagnetization refrigerator (ADR), short of the flight design of 36, but significantly more than we have ever achieved before. My involvement included the selection and preparation of the detector array. I also provided direction during the actual test, determining what data was needed and analyzing that data. Of the 16 channels, 14 were operational. Detector performance was diminished by an apparent excess heat load into the calorimeters. We now think we understand this, have corrected the problem, and preparations for a second test are underway.

### XRS Detector Development

I fine-tuned a procedure for simultaneous attachment of all 36 X-ray absorbers on the detectors of an XRS calorimeter array. I prepared absorbers made from HgTe in two different processes and affixed them to calorimeters so that the processing methods could be evaluated. I have mounted and wired those detectors and have cooled them in a dilution refrigerator; I will be testing them shortly.

### AAS Observatory Report

At the request of Elihu Boldt, the head of the X-ray Astrophysics Branch in which I work, I coordinated the X-ray astrophysics contribution to the AAS observatory report from the Laboratory for High Energy Astrophysics at Goddard.



## Technical report for Michael Loewenstein, 7/1/94-8/31/94

Two papers submitted last quarter – “ASCA Observation of NGC 4636: Dark Matter and Metallicity Gradient” by Mushotzky, Loewenstein, et al. and “Discovery and Implications of Very Low Metal Abundances in NGC 1404 and NGC 4374” by Loewenstein, Mushotzky, et al. – were revised and accepted for publication in the Astrophysical Journal Letters special ASCA issue. We have already received quite a lot of positive feedback from the preprints we sent out.

Analysis of ROSAT PSPC observations of the elliptical galaxy NGC 4697 continues.

I am PI on the following three recently submitted ASCA AO-3 proposals: “X-ray Emission Mechanisms and the Gasdynamical State in Low Luminosity Early-type Galaxies” (Co-Is: Dr. White from the University of Alabama, and Drs. Petre and Schlegel from LHEA), “Search for Low Metallicity Hot Gas in the Compact Elliptical Galaxy NGC 4291” (Co-I: Dr. Mushotzky from LHEA), and “The Nature of the X-ray Emission in NGC 3607” (Co-I: Dr. Petre).

Dr. Mushotzky and I have started working on deriving the limits on dark matter in clusters of galaxies from ASCA data. Our preliminary results will be presented by Dr. Mushotzky at the 5th October Maryland Astrophysics Conference (“Dark Matter”), where I will present our results on dark matter in NGC 4636. I will also give an invited review talk on the subject of elliptical galaxies at the AAS HEAD meeting in California in November, and the Astronomy colloquium at the University of California, Santa Cruz shortly afterwards on the same subject. Finally, I will serve on the ASCA AO-3 peer review in October.

## Report of activity for the period July - September 1994 – Ivan HUBENY

i) I have continued my work in theoretical analysis of hot stars, in collaboration with Drs. S. Heap, T. Lanz, and A. de Koter. In particular, we have proceeded in our analysis of the individual stars in the R136a cluster in 30 Doradus, an sdO star BD+75 325, and the central star of the planetary nebula NGC 7027.

ii) I have given invited talks on “Hydrogen Line Profiles” in the 22nd General Assembly of IAU in Den Haag, Netherlands; and on “NLTE model atmospheres for metal rich white dwarfs” in the workshop on White Dwarfs in Kiel, Germany.

iii) I have continued in a collaboration with Dr. B. Lites (HAO, Boulder) on radiative transfer with partial redistribution; we have submitted a paper on this topic during my short stay in Boulder in July.

iv) I have written a chapter on “Feautrier method and accelerated lambda iteration” for the book “Computational Astrophysics”, which was supplemented by a computer program intended to be a standard reference program of the field.

v) I gave a colloquium at the University of Maryland in College Park on “Recent progress in our understanding of hot stars”.

### *Trips accomplished:*

i) July 14 - 25, Boulder, CO. Collaboration with Dr. B. Lites on radiative transfer with partial frequency redistribution; and with Dr. D. Mihalas on textbook “Stellar Atmospheres”.

ii) Trip to Europe in three parts:

a) August 3 - 9, Prague and Ondrejov, Czech Republic. Giving several colloquia, and collaboration with Dr. P. Harmanec on accretion disk model for the  $\beta$  Lyrae systems.

b) August 17 - 28, Den Hague, Netherlands. Attending the 22nd General Assembly of the International Astronomical Union, and presenting an invited paper on “Hydrogen Line Profiles” on the Joint Discussion 12.

c) August 29 - September 2, Kiel, Germany. attending workshop on White Dwarfs; presenting an invited talk on “NLTE model atmospheres for metal rich white dwarfs”.

### *Papers submitted:*

Hubeny, I., Lites, B.W., “Partial Redistribution in Multilevel Atoms. I. Method and Application to the Solar Hydrogen Line Formation Problem”, *Astrophys. J.* submitted.

Hubeny, I., “Feutrier Method and Accelerated Lambda Iteration”, in *Computational Astrophysics*, ed. by F. Thielemann, R.P. Kudritzki, and D. Mihalas; Springer (submitted)

### *My plans for the next three months include:*

i) I will continue my work in theoretical analysis of hot stars, in collaboration with Drs. S. Heap, T. Lanz, and A. de Koter. In particular, we will concentrate on hot subdwarfs and central stars of planetary nebulae which were recently observed by GHRS of HST.

ii) In collaboration with Drs. S. Heap and T. Lanz we will analyze very-recent GHRS observations of the star  $\beta$  Pictoris, which is believed to be a typical example of a star with a protoplanetary disk.

iii) I will collaborate with Prof. M. Plavec on model atmospheres and accretion disks in cataclysmic variables and symbiotic stars.

iv) I will collaborate with Dr. J. Holberg and his group on theoretical model atmospheres for hot white dwarfs. We plan to determine accurate metal abundances for several representative hot metal rich white dwarfs.

*Travel plans:*

i) November 3 - 11, UCLA, Los Angeles. Collaboration with Prof. M. Plavec on model atmospheres and accretions disks in cataclysmic variables and symbiotic stars.

ii) December 3 - 9, University of Arizona, Tucson. Collaboration with Dr. J. Holberg and his group on theoretical model atmospheres for hot white dwarfs and determining accurate metal abundances of these stars.

(1 July - 30 September 1994)

Name: Paul Barrett  
Activity: 5030-20A-39

## I. SUMMARY

### A. Task Work

#### 1. SAS-2 FITS files and FADMAP program.

The analysis program FADMAP was completed during the 1st Qtr 1994 and was tested during the 2nd Qtr 1994. The SAS-2 and COS-B data were then processed and the results found acceptable. The output FITS files then had to be approved by the OGIP FITS committee and any corrections made. This process took until the end of June when at that time the, hopefully, final version of this program was used to create the SAS-2 and COS-B processed FITS files. These files will then be made available to the public on the HEASARC's 'legacy' computer archive.

The output of the FADMAP program was accepted by the OGIP committee allowing the data to be processed during September. The processed data is now accessible to the public. A final product, which is useful but not required for completion of the task, is to make GIF files of the FADMAP output images. These files will allow easy browsing of the data.

The transferring of the SAS-2 data from 9-track magnetic tape to 8mm DAT tape is halfway complete. It is hoped that this project will be completed soon.

The duplicating of the tapes has now been completed and are ready for the NSSDC to ingest them for storage. Additional documentation is necessary before this can occur.

When the all the data is finally processed and OK by those responsible, final work will begin on documenting the data and the associated reduction program. The possibility of making some paper documents accessible in electronic form has also been considered. These will most likely continue into the 4 Qtr 1994, due to other programmatic work. Except for the delivery of the additional documentation, this project is now considered to be complete.

## 2. GROSSC Tasks

### a. Publication Database on GRONEWS

Work continued on developing a list of publications about the Compton Gamma-Ray Observatory and related gamma-ray issues. Version 1 of this program was completed during the 2nd Qtr 1994. Initial results of this work were used in a presentation to NASA HQ to show the success of the GRO mission.

This database is now publicly accessible using the GRONEWS account at the GROSSC. Continued work involves keeping the publication list as current and complete as possible. Much time was spent during this quarter updating the publication list.

b. During the first week of July, much effort was devoted to preparation of the GRO Phase 4 target list which was necessary for the preparation of the GRO Phase 4 timeline.

## B. Research

### 1. ISO Proposals

Two proposals for the Infrared Space Observatory (ISO) were submitted during July. Several days were spent preparing them. I am the PI on one proposal requesting observations of the cataclysmic variable AE Aqr. We wish to find the break in the synchrotron spectrum of the CV. This data is valuable for models of gamma-ray emission from this source. I am a co-I on the second proposal. This proposal is a survey of about a half-dozen magnetic CVs to detection cyclotron radiation in the IR. These results are important in determining the distribution of magnetic fields for magnetic CV which has a bearing on their evolution.

## 2. ASCA Proposals

Prepared and submitted 2 ASCA proposals entitled "The Link Between Polars and Intermediate Polars: X-Ray Spectra of RX J1712-242 and BG CMi", and "Studies of HEAO-1 Discovered Intermediate Polars". I am PI on both proposals.

## 3. TV Col Data Analysis

Some analysis work of this Cataclysmic Variable was done during the first half of 2 Qtr.

## 4. Soft X-Ray Survey of CV Using Archival ROSAT data.

Some time was spent in late August working on a program to detect sources and determine their flux using ROSAT archival data. The survey is based on a list of known cataclysmic variables. Some further work needs to be done before it's completed.

## 5. Compton/EGRET Data Analysis of Cataclysmic Variables

Results from this work have been submitted to the ApJ with Eric Schlegel as first author. A second paper with myself as first author is still in preparation.

## 6. Compton/COMPTEL & OSSE Data.

Little progress has been made on the COMPTEL and OSSE data due to other more pressing work.

## 7. Present Poster Paper at the ADASS '94 Conference

I presented a paper entitled "Application of Linear Quadrees to Astronomical Databases". This paper discussed the basic types of data structures applicable to two-dimensional data. Table 1 showed how the typical number of operations required to perform a search scaled with the number of records and the type of data structure. It was shown that the best data structures scaled asymptotically with the size and dimension of the file.

## II. FUTURE WORK AND RESEARCH

### A. Task Work

#### 1. COS-B and SAS-2 Documentation.

Documentation for the COS-B and SAS-2 data will be completed. The documentation includes: a discussion of the COS-B and SAS-2 data restoration and a User's Guide to the FADMAP program.

#### 2. Compton GRO Publication Database

Continue enhancing the GRO publication database by adding new publications.

#### 3. Installation of the COMPTTEL Data Analysis Software

The process of installing the COMPTTEL data analysis software will begin. A local implementation of this software will allow visiting scientist to analyze data at the COSSC and for the staff scientist to become more familiar with the data and its analysis.

### B. Research

#### 1. Cataclysmic Variable Research

Work on two papers about gamma-rays from Cataclysmic Variables will continue during the 3rd quarter of 1994 as well as analyzing the other data obtained from my overseas observing trip. It is hoped that these papers will be submitted during this time period.

#### 2. Analysis of ROSAT Data of TV Columbae

It is anticipated that some time will be spent further analyzing ROSAT data of TV Col in preparation for its presentation at a meeting about Cataclysmic Variables in Italy in late June.

## III. MEETINGS AND SYMPOSIA ATTENDED

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July 1 - September 30, 1994:

Production of and delivery archival data has made good progress during the third quarter. Seven full exobyte tapes of data were delivered. These CONT and DISCLA FITS files for TJD 8762 to 9292, and pulsar low level FITS files for TJD 8565 to 8938. For the first time the delivery of CONT and DISCLA FITS files is complete to within a year after data collection, which is the planned delivery schedule.

Guest Investigator visits to MSFC during the 3rd quarter included Richard Schwartz, graduate student Eric Ford working on Marco Travani's investigation of PSR 1259-63, David Smith working on Marv Leventhal's galactic line investigation, and graduate student Vince Kargatiz working on Edison Liang's burst spectra investigation.

In Late July and the first half of August I traveled to Amsterdam where I worked with Michiel van der Klis and Brian Vaughan at the University of Amsterdam on our Vela X-1 guest investigation. In preparation for this visit we had epoch folded the BATSE CONT data at the Vela X-1 pulse period over the whole of the mission. While I was there we finalized our data quality control procedures, calculated pulse phases for the set of about 12000 pulse profiles, and using these phases made estimates of the Vela accretion torque power spectrum using the technique of Deeter. Also during this period I tested a new technique that I have developed for determination of power spectrum, and showed its usefulness in addressing the torque power spectra of pulsars based on phase observations. We are currently writing a paper on our torque power spectrum results. While at the University of Amsterdam I gave a colloquium talk on BATSE observations of x-ray binary pulsars.

After visiting the University of Amsterdam I attended IAU Symposium #165 at the Hague, where I presented an invited talk on BATSE observations of quasi-periodic oscillations in the x-ray binary pulsar A0535+262. This talk was of interest to many in the audience, and was written up in the IAU newspaper "The Sidereal Times".

In September wrote two papers with Tom Prince for the Capri workshop on Imaging in High Energy Astronomy. These were presented by Dr. Prince.



*Plans for the 4rd Quarter:*

By the end of the 4th quarter, I expect that the delivery of burst and solar flare IBDBs, CONT and DISCLA FITS files, and FIT pulsar low level data files will all be brought to within a year of data collection. The major outstanding data delivery problem will then be the delivery of Earth Occultation data. On this front I will be pushing the occultation team for the delivery of a low level (i.e. steps in count rates) data set.

Work will continue on the Vela X-1 torque power spectrum paper, which I expect to be completed in the 4th quarter. We (Michiel van der Klis, Brian Vaughan and I) should then begin writing a paper on the binary orbit of Vela X-1.

I will also be writing a journal paper on the QPO observed in A0535+262. In November I will be presenting result from the analysis of these observations at the HEAD meeting in NAPA, CA. I will also be giving a more extensive talk on the same topic as part of a Symposium series at Goddard.

## QUARTERly REPORT for July 1 - SEPTEMBER 30, 1994

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JOHN MATTOX

During the 3rd quarter of 1994, I wrote ~100 E-mail message in support of EGRET guest investigator activities, and made or received ~20 phone calls. I wrote a proposal to observe EGRET sources with the ISO Infrared Observatory, and finished a paper, "On the Identification of EGRET Sources with Radio Sources."

Regards,  
John

## Quarterly Progress Report for

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Chris R. Shrader, USRA/CGRO -SSC  
(Activities for August - October 1, 1994)

**CGRO Guest Investigator Program:** A large amount of effort was made during the reporting period in preparation for the Cycle-4 CGRO Program. My responsibilities included overseeing efforts of preparing a database of approved targets for input into the timeline generation process, drafting notification letters to the 236 proposers, preparing data-rights guidelines for the approved guest investigations and the principle investigator teams, attending the 3-day timeline committee working group to ensure that the guidelines established by peer-review evaluation were adhered to and handling numerous individual GI and PI team inquiries. Additionally, numerous summary reports, statistics and memoranda were provided upon request to NASA Headquarters and the CGRO project management.

Routine Guest Investigator inquiries, too numerous to list, were handled. Subjects included instrumentation technical details, program policies and procedures and the proposal evaluation process.

The GRONEWS bulletin board was updated to include, for example, summaries of the Cycle-4 peer-review results. 1623 users logged in to GRONEWS during the reporting period. Additionally, the CGRO Biweekly (e-mail) Status Reports were prepared and distributed.

**Project Support:** Efforts continued towards the development of a CGRO exhibit at the National Air and Space Museum (NASM). The exhibit plan presented to NASM during April was returned to the SSC and is currently undergoing and the paper work to fund the exhibit was initiated.

Extensive preparation was made for a presentation to a NASA Headquarters administered "Senior Review requesting an extension (i.e. beyond 1996) of the CGRO mission. An "Extended Mission Proposal", summarizing scientific achievements of the mission to date and presenting a case for future potential was drafted and circulated among the CGRO Instrument Principle Investigators and Project Scientist for review. A detailed database of projected budgetary figures was developed and provided to the Deputy Project Scientist. A presentation detailing the benefits of an extended CGRO mission will be to NASA Headquarters officials during November, 1994. This presentation, to be made by the CGRO project Scientist, will be supported by charts, view graphs and other materials prepared by the SSC.

**CGRO-SSC Group Leader Activities:** An effort to fill the recently vacated OSSE Instrument Specialist position was continued in coordination with USRA management. Extensive consultation with the OSSE Principle Investigator was carried out regarding this matter.

Several internal CGRO-SSC organizational meetings were held to coordinate the various ongoing activities.

Scientific Research: Analysis of OSSE data covering two recent classical novae outbursts, Nova Hercules 1991 and Nova Cygni 1992, was carried out. Preparation for presentation of these results, as well as additional results from COMPTEL observations of the same sources are being prepared for the forthcoming AAS-High-Energy Astrophysics Division meeting.

Extensive analysis on a large body of multiwavelength data for the Seyfert 1 galaxy Markarian 841 was performed. One paper was accepted for publication and another is under preparation. This effort involves a collaboration with several other USRA LHEA scientists (T.J Turner and I.M. George).

# QUARTERLY TECHNICAL REPORT for July - September 1994

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J. GREGORY STACY

DATE: Monday, 3 October 1994

SUBJ: Quarterly report

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## INSTRUMENT SPECIALIST GI-SUPPORT PROGRAM

### *MEETINGS AND PRESENTATIONS:*

Greg participates in weekly meetings at UNH related to instrument operation and performance, COMPASS software development, and the scientific analysis of COMPTTEL data. He also maintains regular contact with colleagues at the SSC at the GSFC. Greg attended and participated in a COMPTTEL team meeting at SRON-Leiden from 25-29 July where he reported on the status of GI-related activities to the COMPTTEL collaboration. Greg continues to prepare the COMPTTEL contribution to the CGRO fortnightly science report, on behalf of the collaboration.

### *GI CONTACTS AND VISITS:*

Greg continues to have regular contact with COMPTTEL Guest Investigators, as do other COMPTTEL team members, at UNH and in Europe. A list of recent GI contacts and/or visits, to the various COMPTTEL sites, includes the following. To UNH: J. Grindlay and R. Manandhar (CfA), E. Frederick (N.E. Science Ctr), C. Shrader (GSFC), T. Vestrand (UNH), D. Meredith (UNH), H. de Brunner (Bern), M. Maisack (Tuebingen), B. McNamara (NMSU), UC/Riverside group. To MPE: M. Maisack (Tuebingen), A. Iyudin (Moscow), W. Brinkmann and L. Norci (MPE). To ESA/ESTEC: R. Buccheri (Palermo), A. Carraminana (Mexico). To SRON/Leiden: C. Dupraz (Meudon).

Greg also hosted visits from J. Bonnell (GSFC) and D. Holdridge (USRA) to discuss SSC-related operations at UNH.

### *DATA ARCHIVE AND DATA ACCESS FOR GIS:*

The COMPTTEL team forwarded to the SSC during this quarter low-level and first high-level data products for the remainder of the Phase 1 Viewing Periods, for inclusion in the CGRO public archive. Preparations continue for the installation of COMPASS at the SSC, pending the set-up of the necessary hardware and software. With R. Freuder of UNH Greg maintains a database of COMPTTEL GI information using the ORACLE database manager.

### *COMPUTER HARDWARE AND SOFTWARE FOR GI SUPPORT:*

With T. Milliman of UNH Greg continues to maintain the GI workstation area at UNH. Greg is updating the COMPTTEL "exposure-calculator" tool for the on-line GRONEWS bulletin board, to include the Cycle 4 timeline, to assist GIs in proposal preparation and archival data searches. Greg is making good progress on an introductory COMPTTEL data-analysis and COMPASS users' guide, both for on-site GI use at UNH, and for remote logins from the SSC; the first public version will be available with the inauguration of COMPASS at the SSC.

### *SCIENTIFIC RESEARCH:*

Greg is pursuing, with European and American colleagues, a NASA ADP project to analyze COBE data. Greg (with T. Vestrand, UNH) continues his study of gamma-ray AGN, including multiwavelength observations; Greg was PI on a submitted ASCA proposal related to gamma-ray AGN. He is coauthor on two COMPTTEL team publications currently in press: one on the Galactic diffuse emission (Strong et al.) and the other on the quasars 3C 454.3 and CTA 102 (Blom et al.). Greg is carrying out a COMPTTEL AGN survey for Phase 1. Greg continues his collaboration with colleagues at both the Harvard-Smithsonian Center for Astrophysics and with the CGRO/EGRET team at Goddard Space Flight Center on several ongoing research projects. He also continues, with others at UNH, his Monte Carlo simulation study of the COMPTTEL detector response, which will be written up shortly for publication.

### *EDUCATIONAL AND "COMMUNITY-OUTREACH" ACTIVITIES:*

With J. Macri of UNH, Greg taught a one-week Elderhostel course, from 18-22 July, on topics of current popular interest in astrophysics. Greg is also co-investigator on three IDEA proposals recently submitted to NASA to undertake local educational initiatives related to NASA projects. Greg is also a volunteer member of the newly-formed Bicycle Planning Committee for the town of Durham, NH (this is a test to see if anybody actually reads this far).

***TASKS FOR THE UPCOMING QUARTER:***

Among his primary tasks for the upcoming quarter Greg will continue to oversee the delivery of COMPTTEL data to the CGRO archive. He will also oversee and coordinate the delivery of the COMPASS data-analysis package to the CGRO SSC; and he will complete and distribute a first version of an introductory COMPASS users' guide for GIs. As always, he will continue to coordinate all guest-investigator activities for COMPTTEL. Finally, he will maintain progress on the various scientific investigations outlined above.

